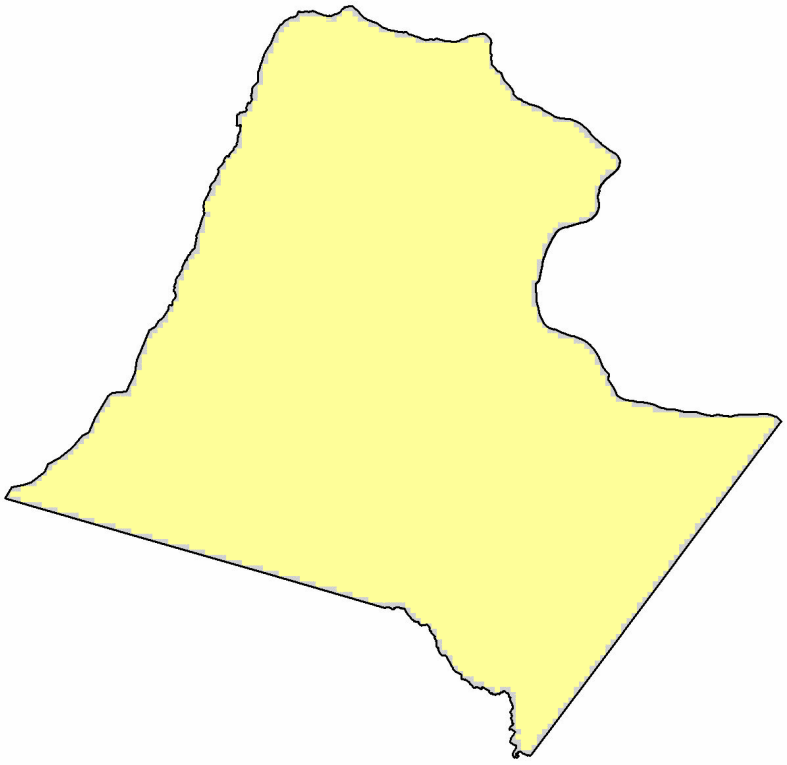
Basic Housing and Employment Data and Projections



Produced for:
Loudoun County Housing Advisory Board
Loudoun County, Virginia

Produced by:
AECOM CONSULT

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Executive Summary

As measured by population or employment, Loudoun County has been among the fastest growing counties in the U.S. for two decades. With this rapid growth has come a steady increase in housing prices. In response to those price increases, the Loudoun County Board of Supervisors appointed the Housing Advisory Board (HAB) to study housing supply and demand issues and affordability of housing and make recommendations to the Board of Supervisors on policy and program development. In undertaking that study, the HAB has identified five key questions related to housing and employment growth in Loudoun County. Those questions and summaries of the findings related to them are listed below.

Question #1: What is the Market Demand for Housing in Loudoun County?

In this analysis, it was assumed that demand for Loudoun County housing would consist of the households that were projected to be in Loudoun County based on the County's official socioeconomic forecast plus some share of workers that currently work in Loudoun County but do not reside there.

Estimating the share of workers that in-commute into Loudoun County and may demand housing there was accomplished by comparing commuting patterns by industry in Loudoun County with a set of peer counties. After analyzing all 3,141 counties in the U.S. a total of 31 counties with similar populations, relatively high earnings, and suburban characteristics were selected as peers. Relative to the set of peer counties it was determined that there were four industries in which a disproportionate amount of in-commuting occurred in Loudoun County in 2003. Those industries include:

- Construction
- Transportation & Warehousing
- Local Government
- Retail trade

Determining that employees in these industries, which include police and fireman, school teachers, shopkeepers and other individuals which most localities would like to have live in and take a stake in their communities was considered a important finding.

The number of housing units required to allow Loudoun County's net commuting in these industries to equal that of its peers was estimated to be 12,578 in 2003. To put that figure in perspective, there were 79,000 housing units in Loudoun County in that year suggesting that an increase of 15.9% in Loudoun County's housing stock would have been required to house these workers.

If similar trends continued in these selected industries, (i.e. assuming that commuting patterns, relative wages, and other factors remained constant) the estimated number of in-commuters in these selected industries that may demand housing in Loudoun County was projected to increase to 29,836. To put that figure in perspective, there are currently projected to be 174,000 housing units in Loudoun County in that year, based on Loudoun County's socioeconomic

forecast, suggesting that an increase of 17.1% in Loudoun County's housing stock would have been required to house these workers.

Question #2: What is the Right Mix of Housing Units in Loudoun County?

The right mix of housing units in Loudoun County was determined by first collecting the mix of housing units projected to occur based on Loudoun County's socioeconomic forecast for the period between 2000 and 2030. That forecast is based on existing, permitted, and approved residential development along with assumptions related to future housing market demand and residential permitting activity. Then, the housing units by type that would be required to house the workers that currently in-commute but may demand housing in Loudoun County, as determined in Question 1, were estimated and used to augment the current forecast.

In Question 1, it was estimated that in 2003, an additional 12,578 housing units were required to house selected in-commuting workers in several industries in which a disproportionately large amount of in-commuting occurred. That figure was projected to increase to 29,836 housing units by 2030. Based on estimated distributions of those employees by occupations and wages, along with projected housing prices, the type of housing unit that each may demand was estimated. Those results are summarized in Table ES-1

Table ES-1. Housing Units Required to House Selected In-Commuters*, By Unit Type

Year	Single Family Detached	Single Family Attached	Multi Family	Total
2003	1,303	8,406	2,869	12,578
Total, by 2030	**2,539**	**13,277**	**14,020**	**29,835**

*Note: * As determined in Question 1.*
Source: AECOM Consult, BLS, Economy.com, and Woods & Poole.

Based on that analysis, it was determined that an additional 2,539 single family detached units, 13,277 single family attached units, and 14,020 multifamily units would be required to house selected in-commuters in 2030. The addition of those units to the current socioeconomic forecast would alter the projected distribution of forecasted housing units by type of unit in Loudoun County as is displayed in Table ES-2.

Table ES-2. Distribution of Housing Units by Type in 2030

Unit Type	Current Socioeconomic Forecast	Forecast Augmented for Selected In-commuters
Single Family Detached	53.5%	46.9%
Single-Family Attached	27.1%	29.6%
Multi-Family	19.5%	23.5%

Source: AECOM Consult, BLS, Economy.com, and Woods & Poole.

Based on the current socioeconomic forecast, Loudoun County's housing stock is projected to be comprised of 54% single family detached, 27.1% single family

attached, and 19.5% multifamily units in 2030. Adding the housing units required to house selected in-commuters would result in an increase in the share of multifamily housing units and single family attached units and a decrease in the share of single family detached units.

Question #3: What should the Annual Supply of Affordable Housing in Loudoun County be?

In order to determine a supply goal of affordable housing, the number of housing units that would be demanded and supplied for various ranges of household income was estimated. Then, shortages and surpluses in available housing for households in each income range were identified. Where shortages existed for households in some ranges, potential goals to provide housing to households in those income ranges were then be proposed.

Shortages and surplus in available housing units for both households that rent and own housing were determined by:

- First the distribution of households in Loudoun County by income range was estimated
- Then, the expenditure that a household in each income range could expend without being overly burdened was estimated. This allowed the number of housing units that would be demanded by households in each income range to be estimated
- Then, the supply of housing units for both rental and owner occupied housing that would be affordable to each income range was estimated
- Finally the supply and demand of housing units by income range was compared to determine where shortages and surpluses exist.

That analysis was conducted for the years 2005 and 2030 for both rental and owner occupied units. That analysis determined that for renters, shortages existed in 2005 for households in the lowest five income ranges and for owners, shortages existed in 2005 for households in the lowest twelve income ranges. Further, that analysis determined that for nearly all income ranges, shortages were projected to worsen between 2005 and 2030.

Several alternative annual affordable housing unit goals have been generated and are displayed in Table ES-3. Those alternatives involve:

- Providing affordable housing sufficient to prevent shortages from worsening by 2030
- Providing affordable housing sufficient to halve shortages by 2030
- Providing affordable housing sufficient to eliminate shortages by 2030

Table ES-3. Potential Annual Affordable Housing Unit Goals

Income Ranges	Annual Housing Units Needed to Maintain Shortage Observed in 2005	Annual Housing Units Needed to Halve Shortage by 2030	Annual Housing Units Needed to Eliminate Shortage by 2030
Rental Units			
Lowest Five Income Ranges	49	133	266
Owner Occupied Units			
Lowest Twelve Income Ranges	238	607	1,213

Source: AECOM Consult, Inc.

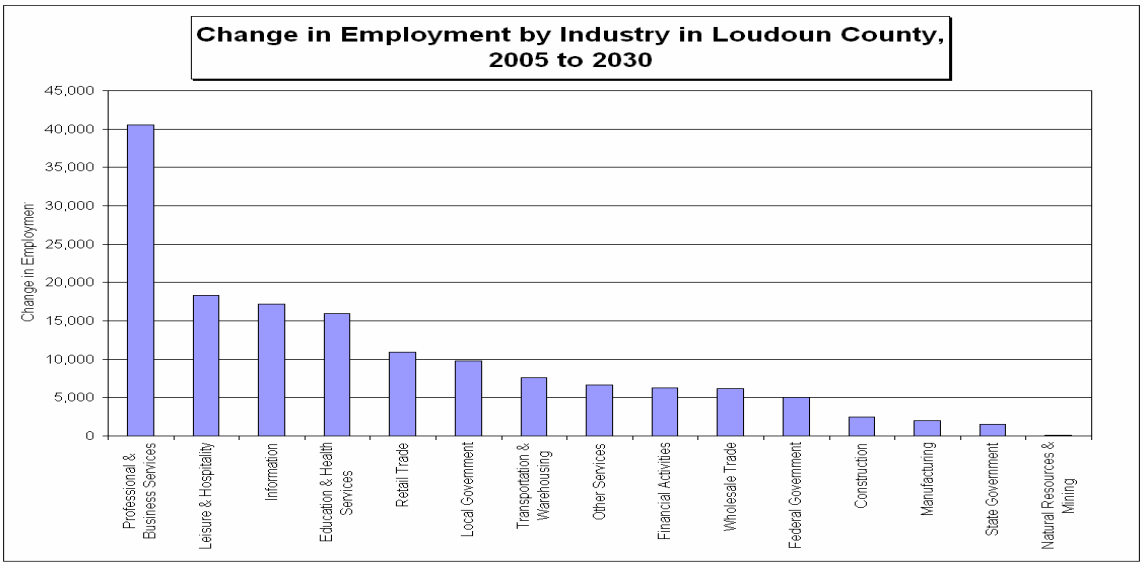
In order to maintain the 2005 shortage of rental units for households in the lowest five income ranges, approximately 49 rental units would have to be provided annually for each year between 2006 and 2030. In order to eliminate projected shortages in rental units for the lowest five income ranges, 266 rental units that would be affordable to households in those income ranges would have to be provided annually from 2006 through 2030. In each case, the majority of those units would have to be affordable to households with incomes between $20,000 and $34,000 annually (in 2000 dollars).

In order to maintain the 2005 shortage of owner occupied units for households in the lowest 12 income ranges, approximately 238 owner occupied units would have to be provided annually for each year between 2006 and 2030. In order to eliminate shortages in owner occupied units, about 1,200 units that were affordable to households in the lowest twelve income ranges would have to be provided annually from 2006 through 2030. The large majority of those units would have to be affordable for households with incomes between $27,000 and $62,000 annually (in 2000 dollars).

Question #4: What Jobs are Coming to Loudoun County and What will they Pay?

To determine the jobs that are coming to Loudoun County the distribution of employment as projected in the Economy.com forecast was applied to total employment as projected in Loudoun County's socioeconomic forecast. That methodology was selected because it would allow total employment figures to agree with those officially accepted by Loudoun County local government officials. The projected change in employment by industry in Loudoun County is displayed in Figure ES-1.

Figure ES-1.

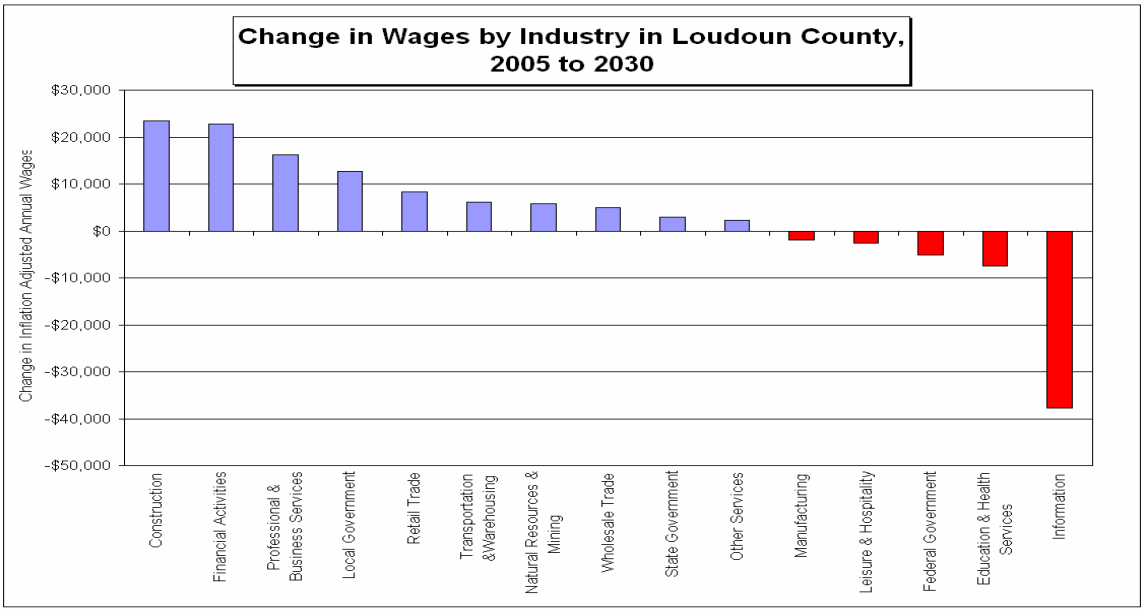


Source: Economy.com and Loudoun County Department of Economic Development.

Between 2005 and 2030, more than half of all employment growth in Loudoun County is projected to occur in the professional & business services, leisure & hospitality, information, and education & health services industries. Strong growth in professional & business services is beneficial as that industry typically generates high wages jobs.

The change in wages per worker between 2005 and 2030 for each of Loudoun County's industries is displayed in Figure ES-2. These figures have been adjusted and are presented in 2005 dollars.

Figure ES-2.



Source: Economy.com.

Wages in Loudoun County's construction, financial activities, professional & business services, and local government are expected to increase significantly by 2030. Most other sectors are projected to experience relatively small changes in real wages per worker with the exception of information, which is projected to experience a substantial decline.[1] An overview of the projected change in employment and the wages that each industry will earn is provided in Table ES-4.

Table ES-4. Employment Change and Wages in Loudoun County

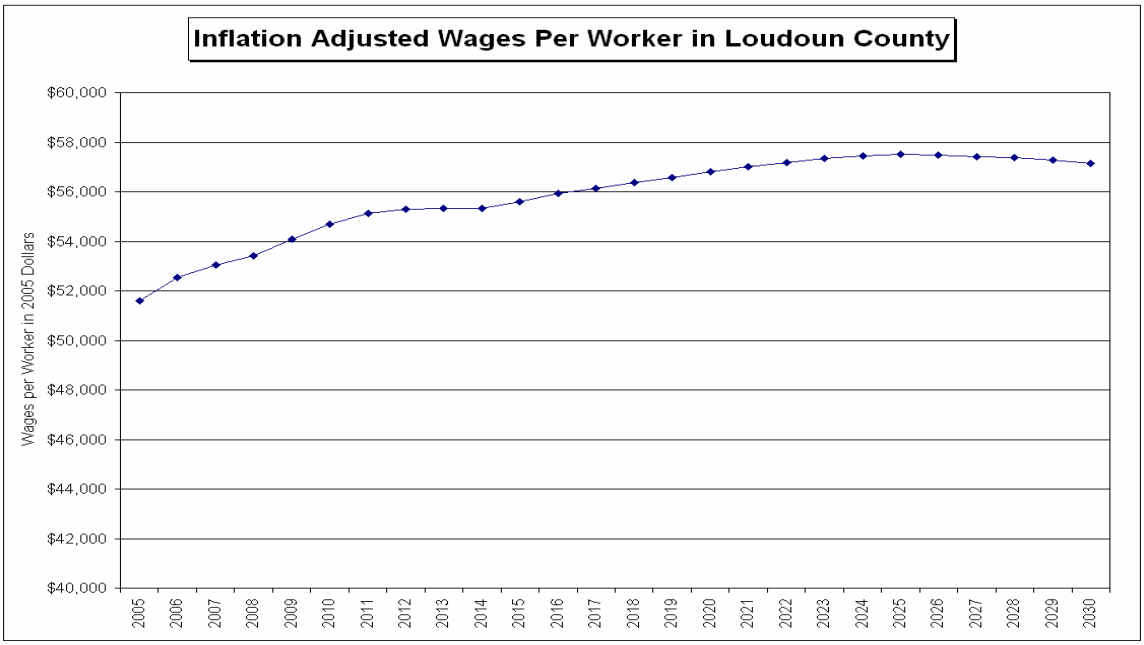
Industry	Employment Change in Loudoun County - 2005 to 2030	Annual Wages in 2030 (in 2005 Dollars)
Professional & Business Services	40,501	$82,772
Leisure & Hospitality	18,310	$14,296
Information	17,145	$66,896
Education & Health Services	15,992	$32,339
Retail Trade	10,962	$33,846
Local Government	9,741	$59,062
Transportation, Warehousing and Utilities	7,617	$52,757
Other Services	6,633	$42,944
Financial Activities	6,294	$81,923
Wholesale Trade	6,143	$74,015
Federal Government	5,041	$89,023
Construction	2,456	$69,738
Manufacturing	1,987	$57,781
State Government	1,501	$21,340
Natural Resources & Mining	99	$25,104

Source: Economy.com and Loudoun County Department of Economic Development.

Having obtained employment and wage forecasts for each industry in Loudoun County, it is possible to determine what the average wage per employee would be for the 2005 to 2030 period. That calculation has been made and is displayed in Figure ES-3. Those figures have been adjusted for inflation and are in 2005 dollars.

[1] Economists from Economy.com have indicated that the fall in information wages per worker may be overstated.

Figure ES-3.



Source: Economy.com.

Earnings per worker in Loudoun County are projected to increase by about 10% over the entire 2005 and 2030 period, after being adjusted for inflation, increasing from about $52,000 in 2005 to $57,000 in 2030. Minor declines in inflation adjusted wages per worker projected to occur in the last few years of the forecast period are related to relatively strong growth in sector such as information and leisure & hospitality, each of which are projected to experience modest decline in inflation adjusted earnings per worker in those years.

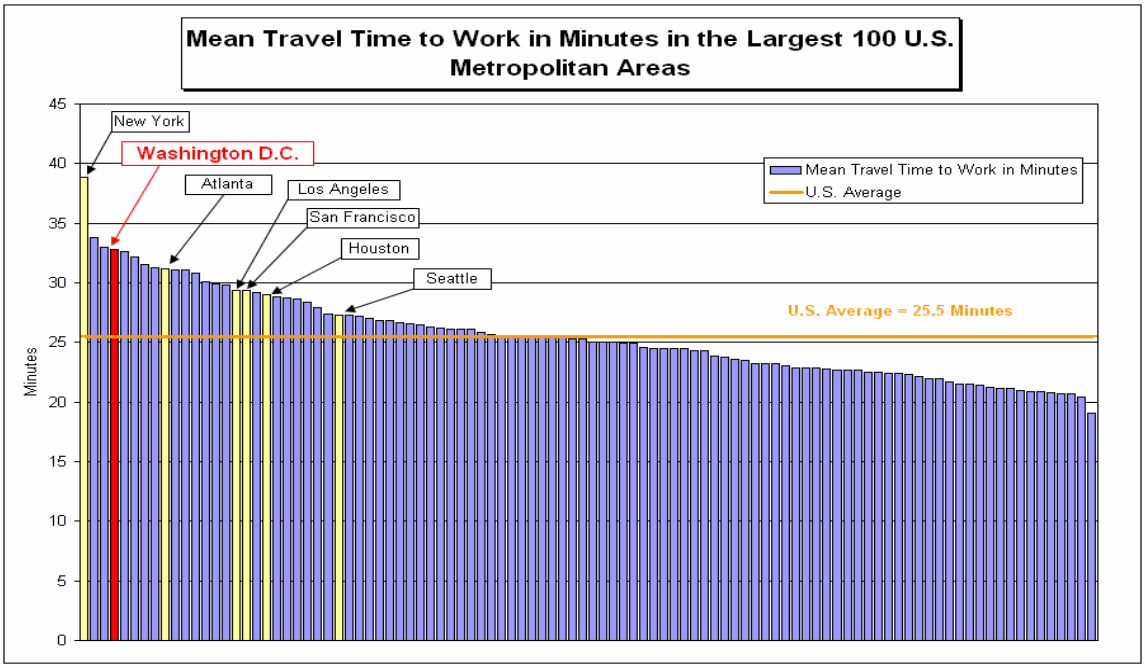
Question #5: What is Considered an Acceptable Commuting Distance?

Because of the impact that congestion can have on commute times, the analysis related to the acceptability of a commute was conducted based in minutes as opposed to distance. There have been several empirical studies that have discussed the extent to which drivers would be willing to commute. In those studies, acceptable commuting times are generally described to be in a range between 30 and 45 minutes for a one-way commute. Other research indicates that the typical tolerable commuting time may be upwards of 45 to 60 minutes at the maximum.

Relative to other large metropolitan areas in the U.S, commuting time is relatively high in the Washington D.C. area. In fact, among the nation's largest 100 Metropolitan areas in terms of population, Washington's mean travel time to work in 2000 was 4th highest behind only New York City, Monmouth-Ocean, NJ, and Nassau-Suffolk, NY. Mean travel times in Washington were higher than other metro areas that are frequently described as having difficult commutes including

Atlanta, Los Angeles, San Francisco, Houston, and Seattle. The mean travel time to work in Washington D.C. and the nation's 100 largest metro areas is displayed in Figure ES-4.

Figure ES-4.



Source: 2000 Census

Washington's relatively high commuting times are not likely to have improved since 2000. Based on the Metropolitan Washington Council of Governments' (MWCOG) periodically produced commuting survey, commuting times in the Washington region increased from approximately 32 minutes to 34 minutes between 2001 and 2004.[2]

Loudoun County residents also faced disproportionately high commuting times in 2000. In that year, the mean travel time to work in Loudoun County was 30.8 minutes. By virtually any comparison, commute times were relatively high in Loudoun County in 2000. Loudoun County's mean travel time to work has been compared with a number of different sets of counties and in each case Loudoun County's commute times are in the top third and in some cases, near the top decile. Commuting time comparisons are displayed in Table ES-5.

[2] That report is entitled *State of the Commute.* The most recent edition was published in 2004 and included results from a survey of 7,200 employed persons in the Washington Metro Area.

Table ES-5. A Comparison of Loudoun County's Mean Commute Time, 2000

Comparison Set	Rank of Loudoun County's Mean Time to Work	Percentile Among Set of Counties
Virginia Counties	41st	30.4%
Fastest Growing 100 Counties (2000-2005)	29th	29.0%
500 Largest Counties (as measured by 2000 population)	50th	10.0%
All 3,141 U.S. Counties	332nd	10.6%

Note: A rank of 1 suggests that the commute time as measured in minutes, is the longest.
Source: 2000 Census

Unfortunately more current data relating to Loudoun County's commuting times are unavailable, however, given the rapid pace of housing construction and employment growth that has occurred in Loudoun County and other exurban counties since 2000, it is likely that commuting times have worsened.

Currently, at 30 or more minutes, Loudoun County commuters are likely at the high end of a range viewed as acceptable. This finding may be even more applicable to in-commuters working in Loudoun County as they may be commuting from other jurisdictions in the region or from jurisdictions in West Virginia or other exurban locations.

Basic Housing and Employment Data and Projections

Introduction

Loudoun County has been among the fastest growing counties in the U.S. for two decades. Most recently, between 2000 and 2005, Loudoun County experienced the nation's second fastest rate of population growth among more than 3,000 counties, behind only Flagler County, FL. In addition, Loudoun County's labor market is among the healthiest in the U.S. For example, through the year ending in August 2005, employment growth in Loudoun County was 6.5 percent, several times higher than the national average employment growth of 1.9 percent in that period. In addition, the unemployment rate in Loudoun County, which was 2.1 percent in September 2005, was well below the national average and was the nation's 19th lowest county. These and other selected economic indicators describing Loudoun County are contained in Table I-1.

Table I-1. Selected Economic Indicators for Loudoun County

	Loudoun County	Rank Among 3,000+ Counties*
Population, 2003 [1]	203,818	264th
Population Growth Rate, 2002-2003 [1]	8.50%	3rd
Employment, 2003 [1]	133,309	249th
Employment Growth Rate, 2002-2003 [1]	5.40%	59th
Per Capita Income, 2003 [1]	$38,269	98th
Unemployment Rate, September 2005 [2]	2.1%	19th (lowest)

*Notes: *The set of comparison counties ranged from 3,134 to 3,257.*
Sources: 1- Bureau of Economic Analysis. 2- Bureau of Labor Statistics.

With this rapid growth has come a steady increase in housing prices. In response to that price increase, the Loudoun County Board of Supervisors appointed the Housing Advisory Board (HAB) to study housing supply and demand issues and affordability of housing and make recommendations to the Board of Supervisors on policy and program development. In undertaking that study, the HAB has identified five key questions related to housing and employment growth in Loudoun County. Those questions, which are listed below, will be addressed in this study.

- **Question #1: What is the Market Demand for Housing in Loudoun County?**
- **Question #2: What is the Right Mix of Housing Units in Loudoun County?**
- **Question #3: What should the Annual Supply of Affordable Housing in Loudoun County be?**
- **Question #4: What jobs are coming to Loudoun County and What will they Pay?**
- **Question #5: What is considered an Acceptable Commuting Distance?**

Question #1: What is the Market Demand for Housing in Loudoun County?

One method of quantifying the demand for housing in Loudoun County is to conduct a survey of residents in jurisdictions in and near the Washington Metropolitan area. In that survey, respondents could be asked where they would prefer to live and what type of housing they would prefer to obtain. The results of that survey could be compiled and could reveal the total number of housing units that are demanded in Loudoun County. Unfortunately, such a survey is beyond the scope of this study.

Instead, this analysis will rely upon existing data in order to estimate the total number of employees that do not currently reside in Loudoun County, but work in Loudoun County. It is believed that some segment of those in-commuters are likely to demand housing in Loudoun County. Housing units that would be required to house those in-commuters could be added to the existing number of households in Loudoun County to estimate the total demand for housing.

The share of employees that in-commute and might therefore demand housing in Loudoun County can be estimated using the following four steps:

- Step 1. A set of counties that are considered to be peers to Loudoun County will be identified.
- Step 2. The level in which in-commuting and out-commuting is occurring will be estimated for each industry in Loudoun County. Similar calculations will be conducted for the set of peer counties.
- Step 3. The share of employees that in-commute in each industry in Loudoun County will be compared with similar figures observed in peer counties. Industries in which net in-commuting in Loudoun County is significantly higher than that observed in peer counties will be identified.[3]
- Step 4. The number of housing units that would be required for Loudoun County's in-commuting levels to equal that observed in peer counties will be calculated for industries in which a disproportionate amount of in-commuting occurs in Loudoun County.

Each of these steps is described in more detail below.

Step 1. Selecting Peer Counties

Peer counties were selected based on three characteristics. First, all 3,142 counties in the U.S. were filtered based on population. Counties that had a population in 2003 that was either less than 150,000 or more than 400,000 were eliminated. That filter ensured that each of the peer counties would have economies that were relatively close in size to that found in Loudoun County. That filter eliminated all but 228 counties.

Second, for those counties within that population range, a filter related to earnings per worker was imposed. Specifically, all counties that had 2003

[3] Since this question is related to housing demand, it was assumed that industries in which a disproportionate amount of net out-commuting occurs are comprised of employees that demand housing in Loudoun County. Therefore, those industries were not analyzed.

earnings per worker that were less than 135 percent of the all U.S. county average were eliminated. This filter ensured that the set of peer counties would have relatively high incomes and reduced the number of peer counties to 72.

Finally, the counties that were not eliminated by the population and earnings per worker filters were analyzed to determine which were suburban (i.e. those that were relatively close to, *but did not include*, urban centers of metropolitan areas). A total of 31 counties met that criterion and were included in the set of peer counties. The peer counties, along with their population, earnings per worker, and nearby metropolitan areas are displayed in Table 1-1.

Table 1-1. Peer Counties

Peer County	Nearby Metro Area	Population (2003)	Earnings Per Worker (2003)
Shelby County, AL	Birmingham, AL	159,641	$39,359
Placer County, CA	Sacramento, CA	293,630	$41,174
Yolo County, CA	Sacramento, CA	181,898	$41,532
Boulder County, CO	Denver, CO	277,467	$46,298
Middlesex County, CT	Hartford, CT	161,637	$46,634
Clayton County, GA	Atlanta, GA	259,741	$43,807
Hamilton County, IN	Indianapolis, IN	220,864	$39,192
Wyandotte County, KS	Kansas City, MO	157,002	$44,295
Kenton County, KY	Cincinnati, OH	152,424	$39,414
Frederick County, MD	Washington, DC	213,623	$38,701
Howard County, MD	Baltimore, MD	263,948	$49,494
Livingston County, MI	Detroit, MI	173,102	$38,992
Monroe County, MI	Detroit, MI	150,894	$42,300
Ottawa County, MI	Grand Rapids, MI	249,547	$40,844
Washtenaw County, MI	Detroit, MI	335,805	$50,826
Dakota County, MN	Minneapolis-St. Paul	373,521	$40,171
Somerset County, NJ	New York, NY	312,330	$71,459
Rockland County, NY	New York, NY	292,969	$47,441
Greene County, OH	Dayton, OH	150,838	$39,232
Cumberland County, PA	Harrisburg, PA	219,622	$40,594
Kent County, RI	Providence, RI	171,542	$38,804
Rutherford County, TN	Nashville, TN	202,225	$42,012
Jefferson County, TX	Houston, TX	248,742	$42,470
Williamson County, TX	Austin, TX	304,024	$40,659
Henrico County, VA	Richmond, VA	271,608	$45,332
Kitsap County, WA	Seattle, WA	239,752	$40,712
Brown County, WI	Appleton, WI	234,269	$39,865
Outagamie County, WI	Green Bay, WI	167,672	$38,868
Racine County, WI	Milwaukee, WI	192,560	$42,624
Rock County, WI	Madison, WI	154,951	$39,388
Waukesha County, WI	Milwaukee, WI	374,186	$44,504
Average	**na**	**231,033**	**$43,129**
Loudoun County, Virginia	Washington D.C.	221,150	$50,459

Source: Bureau of Economic Analysis and AECOM Consult, Inc.

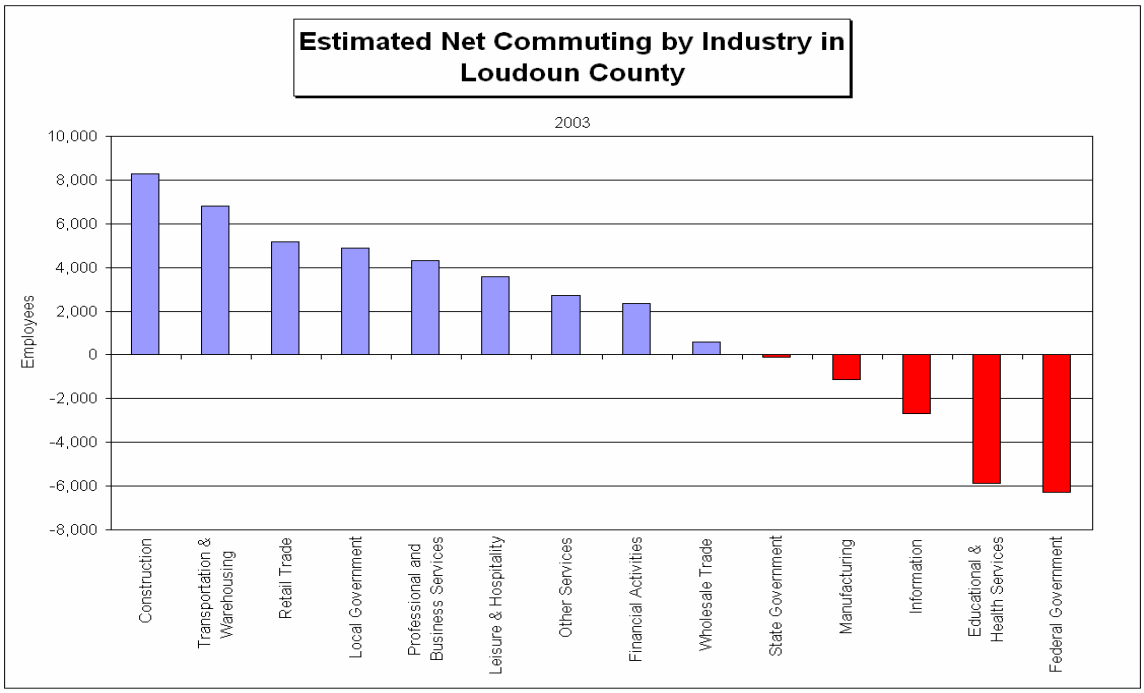
Step 2. Estimating Net In-Commuting and Out-Commuting by Industry

Net commuting patterns can be estimated by comparing each industry's employment by place of residence (i.e. the number of employees as measured by where they live) with employment by place of work (i.e. number of employees

as measured by where they work).[4] Where employment by place of work in a particular industry exceeds employment by place of residence in that industry, then net in-commuting is occurring. It is believed that these in-commuting employees are likely candidates to demand housing in Loudoun County if appropriate housing were available.

Comparing employment by place of work and employment by place of residence at the industry level will demonstrate that for some of Loudoun County's industries, many employees commuted into Loudoun County and for other industries, many employees commuted out of Loudoun County. The estimated net commuting activity for each industry in Loudoun County in 2003 is displayed in Figure 1-1.[5]

Figure 1-1. [6]



Source: AECOM Consult, Inc.

A review of Figure 1-1 demonstrates that on a net basis, in-commuting occurred in Loudoun County in nine industries. Unsurprisingly, the industries with the most in-commuting were construction and transportation & warehousing, where over 8,000 and 6,000 more employees commuted into Loudoun County than did commute out, respectively. The high level of in-commuting in these industries was likely driven by Loudoun County's rapid residential and commercial development and Loudoun County's proximity to Dulles International Airport.

[4] Loudoun County's employment by place of residence and employment by place of work were compared using employment data from the Bureau of Economic Analysis and the 2000 Census. Because of the significant changes that have occurred in Loudoun County since 2000 and because the latest year for which data was available for all peer counties was 2003, 2003 was selected as the year of comparison for this analysis. A description of the data and the adjustments applied to the data is contained in Appendix A.

[5] Agricultural services and mining were omitted from this analysis because in many cases, data for those industries was suppressed. These industries comprised less than 1.1% of total employment in the U.S. in 2003.

[6] A description of each industry is provided in Appendix B.

Other industries in which substantial net in-commuting occurred included retail trade, local government, professional & business services, leisure & hospitality, other services[7], financial activities, and wholesale trade.

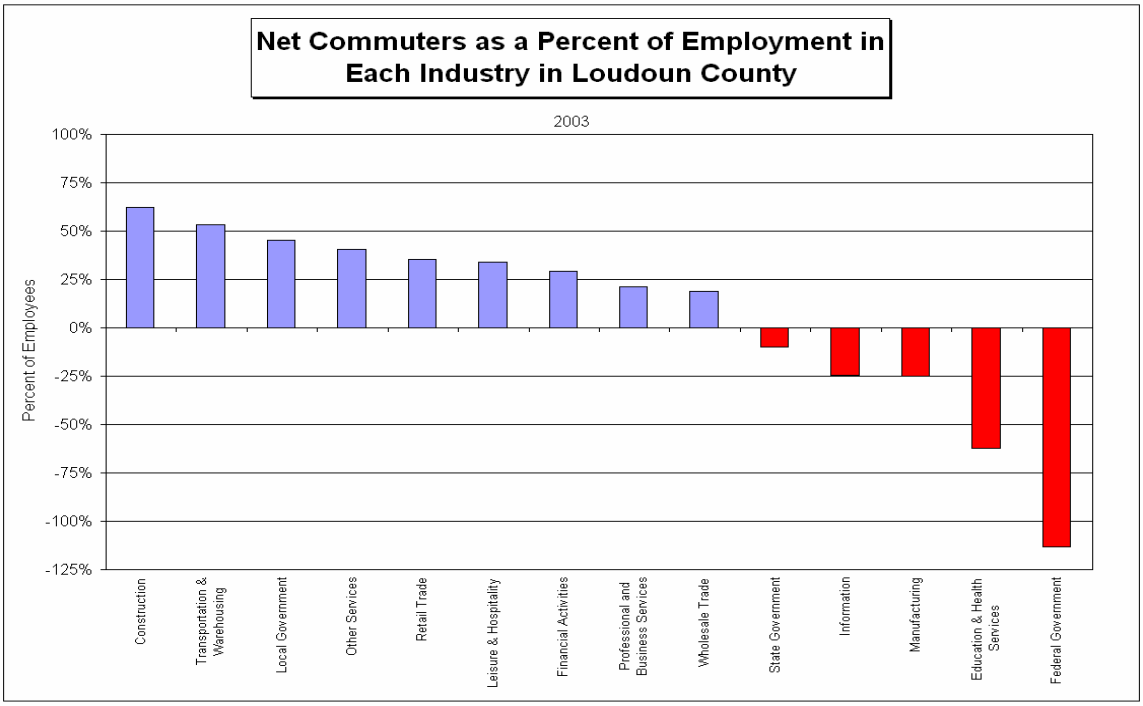
As can also be seen in Figure 1-1, net out-commuting occurred in several industries in Loudoun County in 2003. That pattern was most strongly observed in federal government employment and educational & health services[8]. Net out-commuting in those industries was likely driven by high levels of employment in each of those industries in neighboring jurisdictions. For example, approximately 6,300 more federal government employees commuted out of Loudoun County than commuted into Loudoun County in 2003. That finding is not surprising given Loudoun County's proximity to Washington D.C.

These commuting patterns can be compared with similar patterns in peer counties to determine if discrepancies exist between Loudoun County and its set of peers. However, given differences between the size of Loudoun County's employment base and that observed in peer counties, comparing commuting patterns in Loudoun County and commuting patterns in peer counties first required that those figure be converted to a percentage basis. The share of employees in-commuting into Loudoun County by industry is displayed in Figure 1-2.

[7] Other services includes services that are not elsewhere classified such as equipment and machinery repairing, employment associated with religious activities, dry-cleaning or laundry services, personal care services, death care services, pet care services, photofinishing services, temporary parking services, and dating services.

[8] Educational and health services is primarily comprised of health services. A small portion of that employment is related to education and includes private employment only. Public education is contained within local government.

Figure 1-2.



Source: AECOM Consult, Inc.

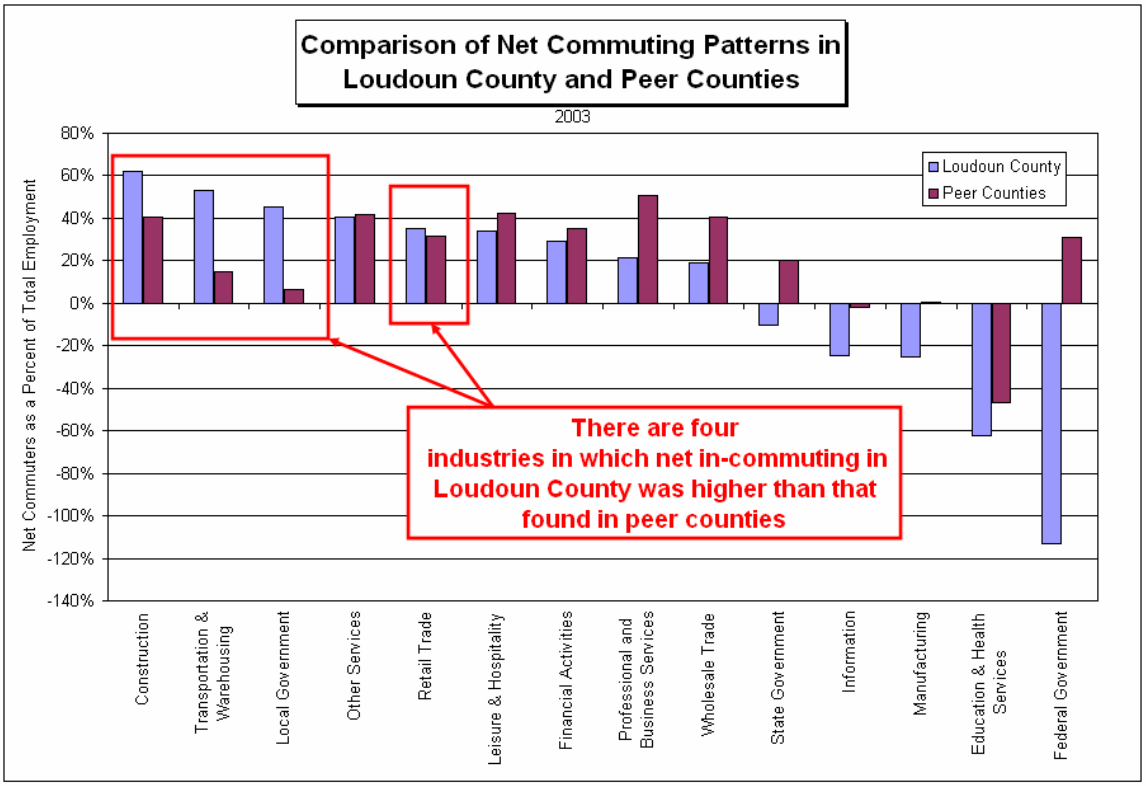
In 2003, about 60% of all Loudoun County's construction employees in-commuted into Loudoun on a net basis. Similarly, about half of Loudoun County's transportation & warehousing employees commuted in from other jurisdictions. About 40% of Loudoun County's local government, other services, and retail trade employment also in-commuted into Loudoun County, on a net basis. To a smaller extent, in-commuting also occurred in several other industries.

The percent of employees that in-commuted in each industry was also calculated for the set of peer counties. That information is compared to the share of employees in-commuting in Loudoun County in the next step.

Step 3. Comparing the Share of In-Commuting Employees in Loudoun County with Peer Counties

Using the same methodology, the share of employees that in-commuted in each industry in the peer counties was calculated. Those figures are compared to similar observations in Loudoun County in Figure 1-3.

Figure 1-3.



Source: AECOM Consult, Inc.

Based on the comparison between Loudoun County and peer counties, it appears that there are four industries in which the share of employees in-commuting in Loudoun County exceeds that observed in peer counties. Those industries include construction, transportation & warehousing, local government, and retail trade. While in-commuting also occurred in Loudoun County in other services, leisure & hospitality, and several other industries, the share of employees that in-commuted did not exceed that which was observed in the set of peer counties.

On a net basis, approximately 60% of Loudoun County's construction employees in Loudoun County in-commuted in 2003 versus about 40% for peer counties. For transportation & warehousing, about half of employees in-commuted in Loudoun County, versus about 15% in peer counties. For local government, approximately 45% of employees in-commuted in Loudoun County in 2003. The comparable figure for peer counties was 6%. This is a key finding as this industry is comprised of teachers, public safety officials, planners, and other employees that local governments would typically like to have living in and taking a stake in their communities. Finally, in retail trade, about a third of Loudoun County's employees in-commuted, slightly higher than the share of in-commuters in peer counties.

Step 4. Estimating the Number of Housing Units Required for Loudoun County's In-Commuting Pattern to Equal Peers

In Step 3, it was found that there were four industries in which the percent of employees in-commuting on a net basis in Loudoun County was higher than that found in peer counties. In order for Loudoun County's in-commuting pattern to be equivalent to that of its peers in those industries, a number of employees would have to relocate to Loudoun County. The extent to which this relocation would have to occur can be estimated by subtracting the share of employees in-commuting in each of those four industry in the set of peer counties from that observed in Loudoun County and multiplying that difference by the total employment in each of those industries in Loudoun County. These calculations have been made and are displayed in Table 1-2.

Table 1-2. Employees Required to be Housed in Loudoun County for Loudoun County's In-Commuting Pattern to Equal Peers

Industry	Percent of Net In-Commuting Employees		Difference Between Loudoun County and Peers	Employment in Loudoun County in 2003	Employees Required to be Housed in Loudoun for Loudoun's In-Commuting Pattern to Equal Peers
	Loudoun County	Peer Counties			
Construction	62.1%	40.8%	21.3%	13,331	2,837
Transportation & Warehousing	53.1%	14.6%	38.5%	12,845	4,950
Local Government	45.3%	6.3%	39.0%	10,814	4,221
Retail Trade	35.2%	31.3%	3.9%	14,679	570
Total	**na**	**na**	**na**	**na**	**12,578**

Source: Bureau of Economic Analysis and AECOM Consult, Inc.

In Steps 1 through 3, it was determined that there were four industries in which the level of net in-commuting that was occurring in Loudoun County in 2003 was higher than that observed in peer counties. In order for Loudoun County's net in-commuting in those industries to be similar to that found in peer counties, approximately 12,578 employees would have had to relocate to Loudoun County. Assuming that each of those employees required housing, the maximum number of housing units required to house them would have been 12,578 in 2003.[9] To put that figure in perspective, there were approximately 79,000 housing units in Loudoun County in 2003.

Determining Demand for Future In-Commuters

In this analysis, it is assumed that the share of in-commuting employees in the four industries in which a disproportionate portion of employees in-commute into Loudoun County would remain constant in both Loudoun County and the set of peer counties. Given that assumption, the number of employees requiring housing in Loudoun County in order for Loudoun County to have similar net in-

[9] In reality, some of those employees would likely either cohabitate or live with a person otherwise employed in Loudoun County. However, the share of employees for which this would be true was difficult to estimate therefore, it was assumed that each in-commuting employee would require housing.

commuting patterns as that observed in peer counties for those industries can be estimated by multiplying the difference in the share of employees that in-commute in Loudoun County and the peer counties in those four industries times the projected employment in Loudoun County in each of those industries.[10] Those figures are displayed in Table 1-3.

It is important to reiterate that this analysis assumes that in-commuting patterns as estimated in Steps 1 through 4 would remain constant. Changes in those in-commuting patterns that could result from changes in housing prices, industry wages, or many other factors could have a significant impact on these results.

Table 1-3. Maximum and Yearly Additional housing Units Required to House Selected In-Commuters

Year	Employees Required to be Housed in Loudoun for Loudoun's In-Commuting Pattern to Equal Peers					Maximum Additional Housing Units Required for Loudoun County to Equal Peers*	Yearly Additional Housing Units Required for Loudoun County to Equal Peers
	Construc-tion	Transport -ation and Utilities	Local Govt.	Retail Trade	Total		
2003	2,837	570	4,950	4,221	12,578	12,578	na
2004	3,290	569	5,271	4,334	13,465	13,465	886
2005	3,680	568	5,694	4,673	14,615	14,615	1,150
2006	3,949	568	6,031	5,015	15,563	15,563	947
2007	3,961	567	6,366	5,329	16,223	16,223	660
2008	4,191	566	6,650	5,615	17,022	17,022	799
2009	4,306	566	6,965	5,907	17,743	17,743	721
2010	4,446	565	7,283	6,181	18,475	18,475	732
2011	4,640	565	7,589	6,445	19,239	19,239	764
2012	4,836	564	7,883	6,702	19,986	19,986	747
2013	5,027	564	8,173	6,957	20,722	20,722	736
2014	5,179	563	8,466	7,207	21,415	21,415	694
2015	5,313	563	8,764	7,450	22,090	22,090	675
2016	5,421	563	9,076	7,690	22,750	22,750	660
2017	5,490	562	9,386	7,934	23,372	23,372	622
2018	5,484	562	9,701	8,180	23,928	23,928	555
2019	5,443	562	10,012	8,425	24,443	24,443	515
2020	5,363	561	10,325	8,672	24,922	24,922	479
2021	5,256	561	10,640	8,925	25,381	25,381	460
2022	5,152	561	10,951	9,179	25,843	25,843	461
2023	5,048	561	11,257	9,427	26,292	26,292	449
2024	4,939	560	11,563	9,671	26,734	26,734	442
2025	4,889	560	11,868	9,914	27,232	27,232	498
2026	4,950	560	12,162	10,143	27,814	27,814	583
2027	5,004	560	12,458	10,363	28,385	28,385	570
2028	4,945	560	12,755	10,586	28,845	28,845	461
2029	4,914	559	13,063	10,803	29,340	29,340	494
2030	4,889	559	13,371	11,016	29,836	29,836	496

*Note: * These figures assume that each in-commuting employee that would relocate to Loudoun County would demand their own housing unit. In reality, some unknown share of those employees would either cohabitate or live with an employee that works in Loudoun County.*
Source: AECOM Consult, Inc.

Based on these analyses and assuming that commuting patterns as described in Step 2 remain constant, the maximum number of housing units that would be

[10] Employment projections were based on data obtained from Economy.com.

required to house selected in-commuters would be 29,836 by 2030. To put that figure in perspective, the current socioeconomic forecast projects that there will be about 175,000 housing units in Loudoun County in that year.[11] The maximum addition of 29,836 housing units represents an increase of about 17% in housing units above the Loudoun County socioeconomic forecast.

[11] Loudoun County routinely publishes a socioeconomic forecast that is used for planning and budgeting, and is also used as Loudoun County's input into the regional cooperative forecasting process. That forecast is based on existing, permitted, and approved development, 2000 Census data, and assumptions related to demand for future residential and non-residential development. Those assumptions are developed by the Fiscal Impact Committee and are revised every two years. That committee consists of local officials, developers, members of the financial industry, and other private sector representatives. The latest forecast was updated in 2004.

Question #2: What is the Right Mix of Housing Units in Loudoun County?

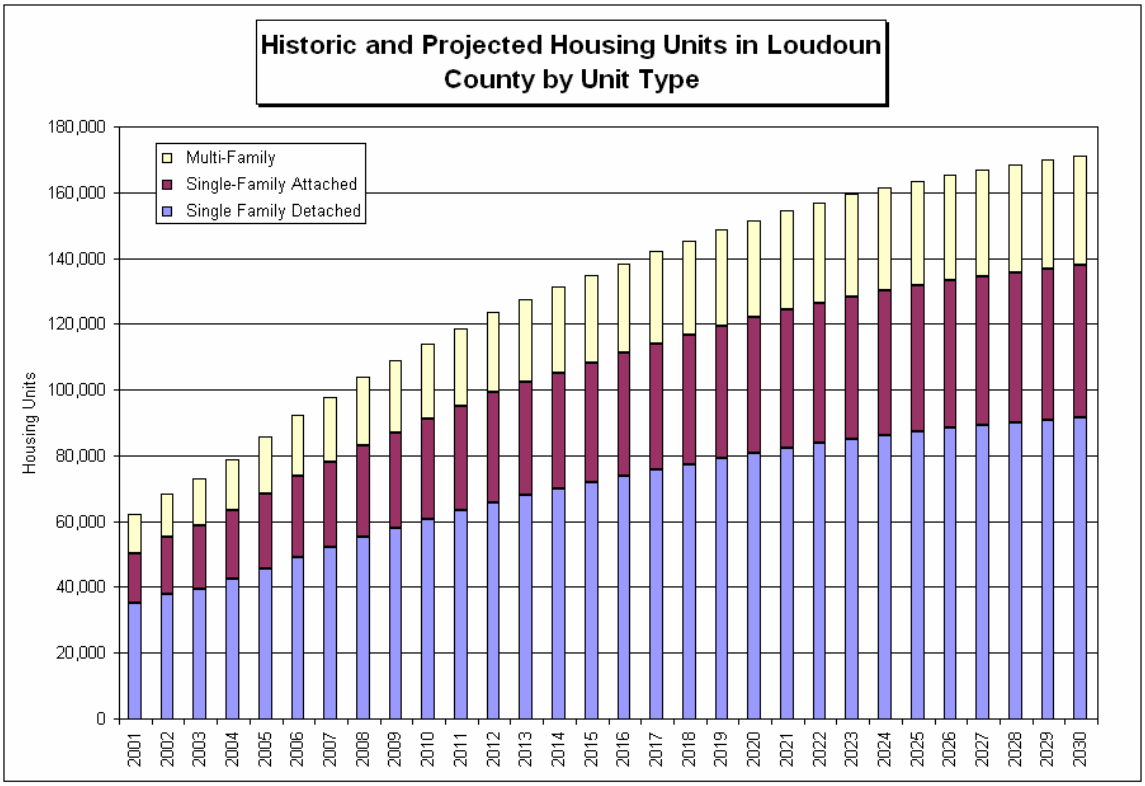
Loudoun County's Department of Economic Development currently maintains a socioeconomic forecast for the period between 2000 and 2030 that disaggregates housing units by unit type (i.e., single family detached, single family attached such as townhouses, and multifamily such as condos) for each planning subarea in Loudoun County. Those forecasts are based on existing, permitted, and approved residential development along with assumptions related to future housing market demand and residential permitting activity. Those assumptions are developed by the Fiscal Impact Committee and are revised every two years. That committee consists of local officials, developers, members of the financial industry, and other private sector representatives. The latest forecast was updated in 2004.

For this analysis, the existing mix of housing units in Loudoun County from that forecast will be used as a base. Then, the housing units by type that would be required to house the workers that currently in-commute but may demand housing in Loudoun County, as determined in Question 1, will be estimated and used to augment the current forecast. This section will begin by outlining the housing unit mix contained in the current socioeconomic forecast, and then the methodology used to conduct this analysis will be described.

The Housing Unit Mix in Loudoun County

In 2003, there were about 79,000 housing units in Loudoun County, the largest share of which was single family detached units. In fact, in that year, Loudoun County's housing stock was comprised of 54% single family detached units, 26% single family attached units, and about 20% multifamily units. By 2030, the distribution of housing units by type is projected to be relatively unchanged with single family detached units comprising 53.5%, single family attached units comprising 27.1%, and multifamily units comprising 19.5% of the total housing stock. Loudoun County's housing stock, based on Loudoun County's latest socioeconomic forecast is shown in Figure 2-1. The projected growth in total housing units in Loudoun County is evident in that figure.

Figure 2-1.



Source: Loudoun County Department of Economic Development.

Housing Units Required to House In-Commuting Workers

In Question 1, it was estimated that in 2003, an additional 12,578 housing units would be required to house in-commuting workers in several industries in which a disproportionately large amount of in-commuting occurred. That figure was projected to increase to 29,836 housing units by 2030. Determining the type of housing units that those workers could afford and might therefore demand required two steps.

- First, housing unit prices for each type of unit were projected to 2030
- Second, the distribution of units that in-commuters could afford and therefore may demand was estimated

These steps are described in more detail below.

Housing Unit Prices

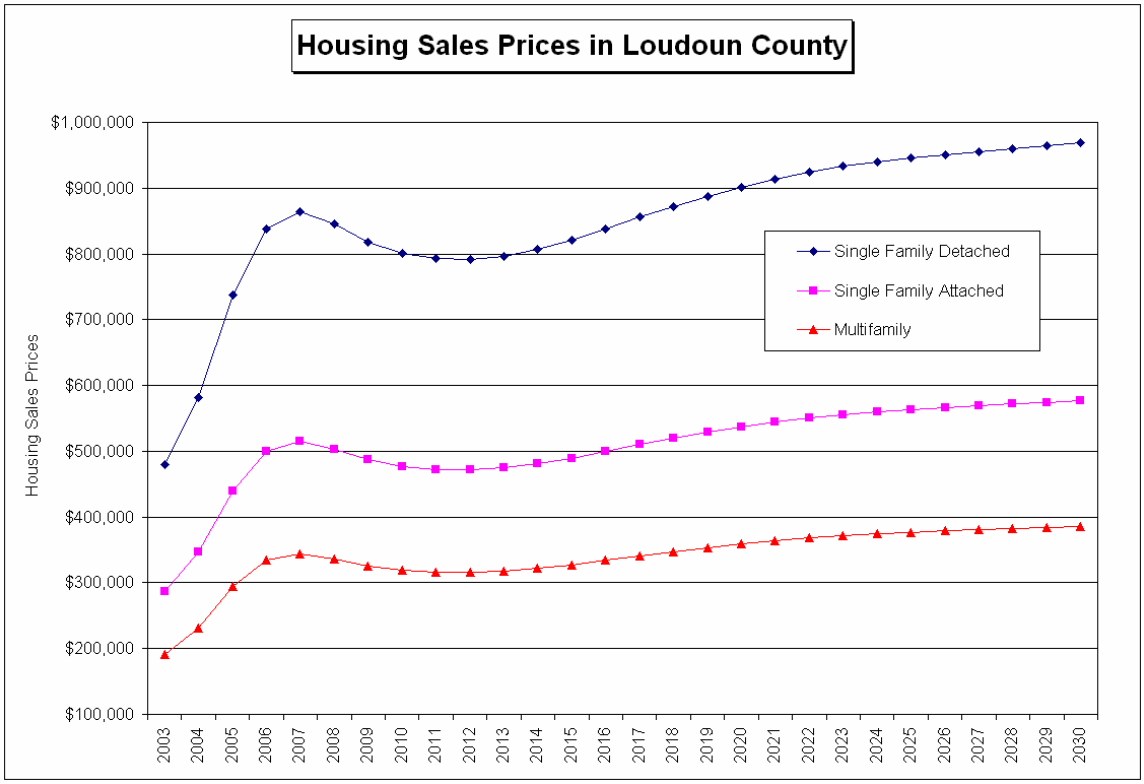
A forecast of housing sales prices for all units, regardless of type, was obtained from Economy.com for each of the years between 2003 and 2030.[12] However, in

[12] Because data from that source included values that were lower than those historically observed in the 2003 to 2005 period, that series was adjusted based on observed historical prices. Historical sales prices were obtained from Loudoun County's' Department of Financial Services.

order to conduct this analysis, it was necessary to estimate sales prices by unit type.

Housing sales prices by unit type were estimated by multiplying the total projected housing sales price for all units by a ratio for each of the unit types. For example, historical sales prices for single family detached units were, on average, approximately 130% higher than the all unit average in Loudoun County during the 1999 to 2005 period. Similarly, historic sales prices for single family detached and multifamily units in Loudoun County were, on average, 77.4% and 51.8% of the all unit average, respectively. These ratios, which were relatively stable during the 1999 to 2005 period, were multiplied by the projected sales price for all units in Loudoun County from 2006 to 2030 to produce a forecast of sales prices by unit type. Those values have been calculated and are displayed in Figure 2-2.

Figure 2-2.



Source: Economy.com and AECOM Consult.

The rapid increase in housing prices from 2003 through 2006 is evident in that figure. Also, based on the Economy.com forecast, housing sales prices growth is projected to slow in the near future and is projected to decline for several years before returning to a steady upward trend.

Determining the Distribution of Units that In-Commuters May Demand

In Question 1, it was determined that approximately 3,000 in-commuting construction workers, about 600 in-commuting retail workers, about 5,000 in-commuting transportation workers and about 4,000 in-commuting local government employees might have demanded housing in Loudoun County in 2003. Given information about occupations and wages in those industries and estimates of housing costs by unit type, it is possible to estimate the type of housing that those employees would demand. However, that analysis required several assumptions:

- First, it was assumed that each industry had the same occupational mix in Loudoun County as that observed in the U.S. For example, it is assumed that the construction industry is made up of 5.1% management occupations, 9.5% office and administration occupations, 66.8% construction and extraction occupations, and so forth. In addition, it is assumed that these shares of employment by occupation will remain constant over the 2003 to 2030 period.

- Second, it was assumed that the ratio between wages for each occupation and that occupation's overall industry is the same in Loudoun County as that observed in the U.S. For example, it is assumed that management occupations within retail earn about 300% of the retail industry average earnings while sales and related occupations earn about 89% of the retail industry average earnings. Again, it is assumed that the relationship between wages for each occupation and the overall industry wage will remain constant over the 2003 to 2030 period.

- Third, it was assumed that each household would have more than one employee per household. The number of employees per household used in this analysis was based on data obtained from Woods & Poole. That figure varied between 1.55 and 1.61 during the 2005 to 2030 period. It is also assumed that each of those employees has identical annual wages.

- Finally, it was assumed that each household would demand housing given the following assumptions:

    - Housing would cost no more than 30% of total income
    - Housing costs would be calculated based on a 7% interest rate and a 10% down payment
    - Any household not qualifying for single family detached or single family attached housing would demand multifamily housing

Each of the four industries analyzed in this section (construction, retail, transportation & warehousing, and local government) were disaggregated into occupations based on the U.S. occupational mix. In some cases, those occupations had earnings significantly higher than the average industry earnings

while others did not. It is therefore important to first disaggregate each industry by occupation before determining what type of housing in-commuters might demand.

Disaggregating employment by occupation can be accomplished using national industry-specific occupational employment and wage estimates published by the Bureau of Labor Statistics. An example of that data is provided for transportation & warehousing in Table 2-2.[13]

Table 2-2. Industry-Specific Occupational Employment and Earnings Estimates for Transportation & Warehousing in the U.S.

Occupation	Occupation as a Percent of Industry	Earnings Relative to Industry Average
All Occupations	100%	100%
Management Occupations	3%	200%
Business and Financial Operations Occupations	2%	139%
Computer and Mathematical Occupations	1%	155%
Architecture and Engineering Occupations	0%	154%
Life, Physical, and Social Science Occupations	0%	148%
Community and Social Services Occupations	0%	75%
Legal Occupations	0%	243%
Education, Training, and Library Occupations	0%	116%
Arts, Design, Entertainment, Sports, and Media Occupations	0%	115%
Healthcare Practitioner and Technical Occupations	0%	116%
Healthcare Support Occupations	0%	60%
Protective Service Occupations	0%	84%
Food Preparation and Serving Related Occupations	0%	59%
Building and Grounds Cleaning and Maint. Occupations	1%	81%
Personal Care and Service Occupations	3%	110%
Sales and Related Occupations	2%	119%
Office and Administrative Support Occupations	30%	93%
Farming, Fishing, and Forestry Occupations	0%	69%
Construction and Extraction Occupations	1%	108%
Installation, Maintenance, and Repair Occupations	6%	108%
Production Occupations	1%	91%
Transportation and Material Moving Occupations	50%	93%

Source: Bureau of Labor Statistics, 2004.

As can be seen in Table 2-2, in some cases certain occupations earn significantly more than the industry average while others earn significantly less. In addition, the relative size of each occupation differs considerable. For example, management occupations within transportation & warehousing earn 200% of the all industry average wage, but comprise 3% of the total industry. Conversely, office and administrative support occupations comprise 30% of that industry but earn only 93% of the all industry wage.

Having obtained an estimate of the distribution of occupations and an estimate of the relative wages for each occupation, the type of housing unit demanded by each occupation in each of the four industries can be estimated. An example of that analysis is presented in Table 2-3.

[13] These data can be obtained for each industry by accessing http://www.bls.gov/oes/current/oessrci.htm.

Table 2-3. An Example of the Calculations Used to Determine the type of Housing an In-Commuter May Demand[14]

Row	Measure	Value	Source
1	Estimated number of transportation & warehousing workers demanding housing in Loudoun County in 2003	4,950	Question #1
2	Share of workers in Management	3.2%	BLS
3	Estimated number of workers	156	Row 1 * Row 2
4	Wages as a percent of industry average	200%	BLS
5	Estimated all industry average wage	$44,636	Economy.com
6	Estimated wage for Management	$89,351	Row 4 * Row 5
7	Employees per household*	1.63	Woods & Poole
8	Estimated household wages	$145,712	Row 6 * Row 7
9	Wages needed to qualify for SFD	$98,631	AECOM
10	Wages needed to qualify for SFA	$58,768	AECOM
11	Wages needed to qualify for MF	$39,298	AECOM
12	Type of housing which these employees were assumed to demand	SFD	AECOM
13	Share of workers in Protective Services	0.3%	BLS
14	Estimated number of Workers	16	Row 1 * Row 13
15	Wages as a percent of Industry Average	84%	BLS
16	Estimated All Industry Average Wage	$44,636	Economy.com
17	Estimated wage for Protective Services	$37,327	Row 15 * Row 16
18	Employees per household*	1.63	Woods & Poole
19	Estimated household wages	$60,873	Row 17 * Row 18
20	Wages needed to qualify for SFD	$98,631	AECOM
21	Wages needed to qualify for SFA	$58,768	AECOM
22	Wages needed to qualify for MF	$39,298	AECOM
23	Type of housing which these employees were assumed to demand	SFA	AECOM

*Notes: *In determining the estimated household wage, it was assumed that each household had 1.63 workers, per Woods & Poole data. SFD = single family detached; SFA = single family attached; MF = multifamily*
Source: AECOM Consult, BLS, Economy.com, and Woods & Poole.

Similar calculations were conducted for each occupation in each of the four industries analyzed in this section. Those calculations were conducted for all years from 2003 to 2030 based on corresponding earnings, employees per household, and housing cost data. Those results were compiled and are displayed in Table 2-4.

[14] Estimated all industry average wages for each industry were obtained from Economy.com and are described in more detail in Question 4. Data describing employees per households were obtained from Woods & Poole for Loudoun County for the period between 2000 and 2030.

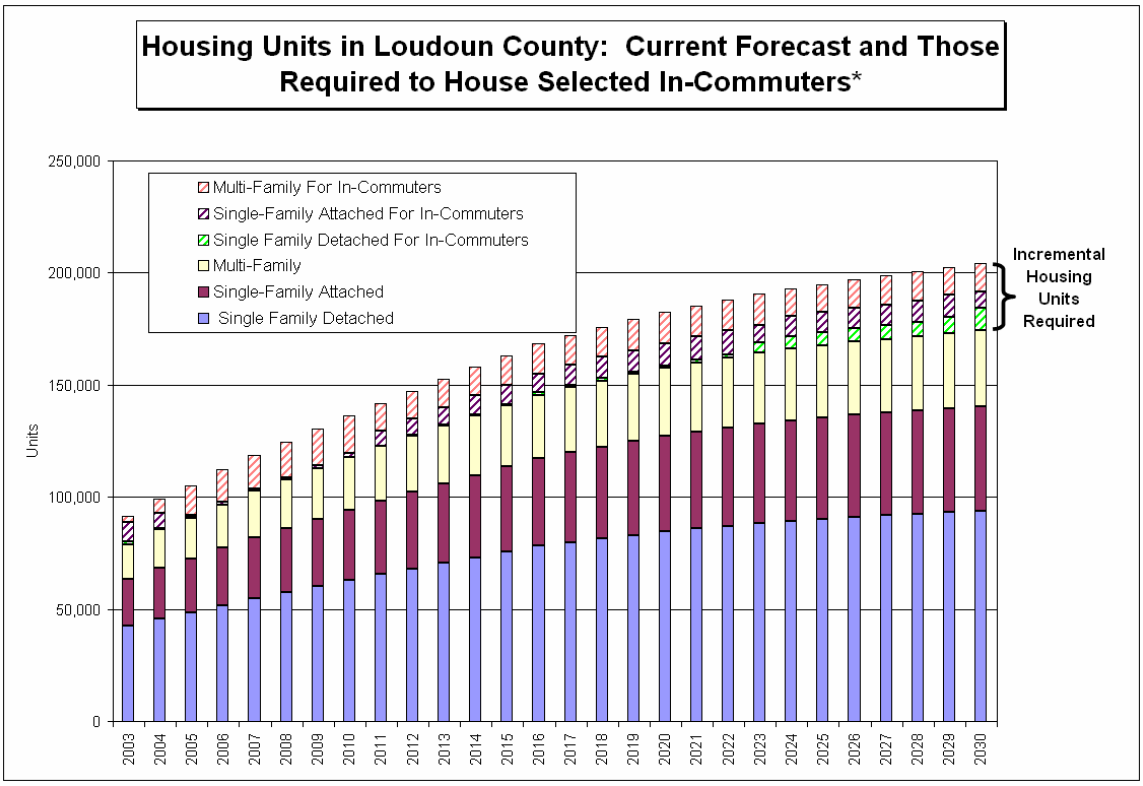
Table 2-4. Housing Units Required to House Selected In-Commuters*, By Unit Type

Year	Total	Single Family Detached	Single Family Attached	Multi Family
2003	12,578	1,303	8,406	2,869
2004	886	32	459	395
2005	1,151	15	85	1,051
2006	948	0	62	886
2007	660	8	38	614
2008	799	10	50	739
2009	722	9	55	658
2010	731	9	67	655
2011	764	9	256	499
2012	746	9	268	469
2013	736	9	277	450
2014	694	13	271	410
2015	675	14	262	399
2016	660	29	240	391
2017	622	27	240	355
2018	555	24	219	312
2019	515	24	199	292
2020	479	25	190	264
2021	461	26	188	247
2022	461	26	191	244
2023	450	82	127	240
2024	440	90	148	202
2025	498	102	166	230
2026	584	129	185	270
2027	570	125	181	264
2028	461	102	151	208
2029	493	121	170	202
2030	496	165	126	204
Total	**29,835**	**2,539**	**13,277**	**14,020**

*Note: * As determined in Question 1.*
Source: AECOM Consult, BLS, Economy.com, and Woods & Poole.

The results of this analysis suggest that housing the selected in-commuting employees in 2003 would primarily have required single family attached units with a smaller share of multifamily units and single family detached units. However, the number of multifamily units required to house in-commuters is projected to increase at a faster rate than other units during the forecast period. In fact, by 2030, the distribution of units required to house selected in-commuting employees is projected to be 8% single family detached, with the remaining units fairly evenly divided between multifamily and single family attached units. The units required to house selected in-commuting employees have been added to the existing housing unit forecast, which is displayed in Figure 2-3.

Figure 2-3.



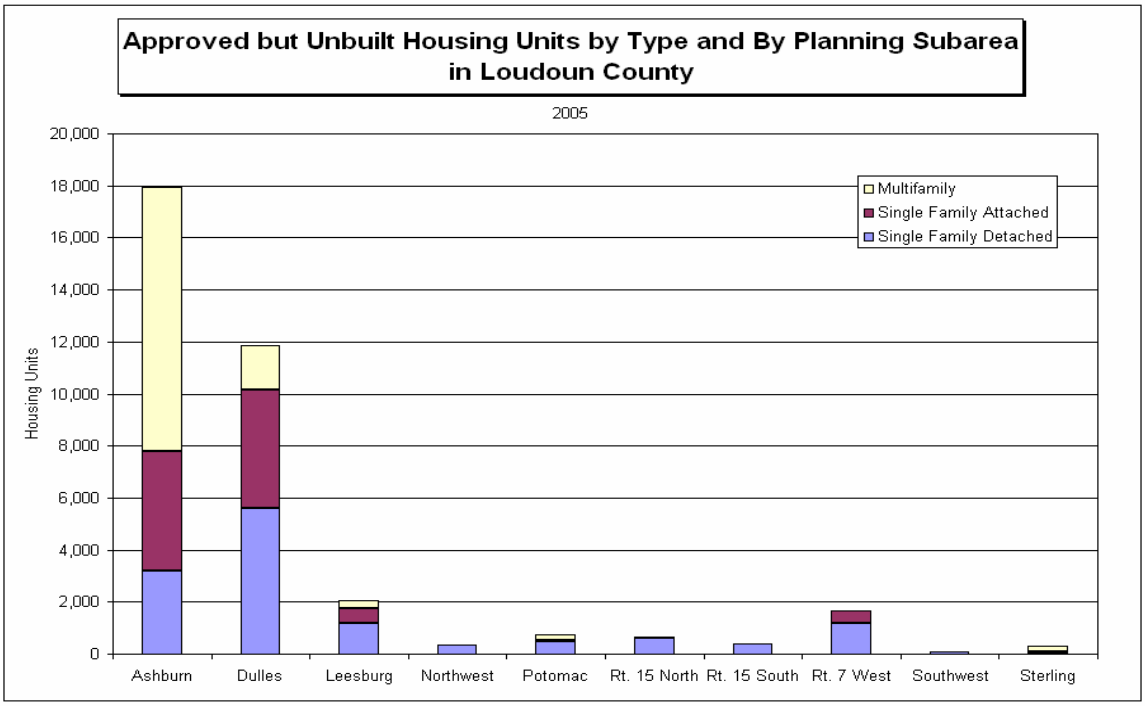
*Note: * As determined in Question 1.*
Source: Loudoun County's Budget Office and AECOM Consult, Inc.

Disaggregating Housing Units by Planning Subarea

It was estimated that by 2030 an additional 2,539 single family detached units, 13,277 single family attached units, and 14,020 multifamily units would be required to house selected in-commuters in Loudoun County. Those units can be disaggregated into planning subareas based on current observations of approved but unbuilt residential development in Loudoun County.

Based on 2005 data, the majority of approved but unbuilt housing units, of any type, are located in either Ashburn or Dulles. Approved but unbuilt units by unit type and planning subarea in Loudoun County as of 2005 are displayed in Figure 2-4.

Figure 2-4.



Note: Figures only include units within residential development projects of 20 or more units.
Source: Loudoun County Department of Economic Development's 2005 Annual Growth Summary.

Based on the observed availability of approved but unbuilt units in Loudoun County, the distribution of units by planning subarea that would be required to house selected in-commuters can be determined. That distribution is estimated by multiplying the share of approved but unbuilt units in each planning subarea by the number of units required for in-commuters through 2030. The results of those calculations are displayed in Table 2-5.

Table 2-5.

	Single Family Detached by 2030	Single Family Attached by 2030	Multifamily by 2030	Total by 2030
Ashburn	622	5,862	11,300	17,784
Dulles	1,083	5,848	1,894	8,825
Leesburg	228	713	352	1,293
Northwest	65	0	0	65
Potomac	92	93	241	426
Rt. 15 North	120	42	0	162
Rt. 15 South	76	0	0	76
Rt. 7 West	228	630	0	858
Southwest	18	0	0	18
Sterling	8	87	233	328
Total	**2,539**	**13,277**	**14,020**	**29,835**

Source: Loudoun County Department of Economic Development's 2005 Annual Growth Summary *and AECOM Consult*.

If the housing units required to house selected in-commuters were distributed based on currently approved but unbuilt residential development, than by 2030 an overwhelming majority of those units would be located in the Ashburn and Dulles subareas.

Question #3: What Should Loudoun County's Annual Supply Goal for Affordable Housing Be?

In order to determine a supply goal of affordable housing, the number of housing units that would be demanded and would be supplied for various ranges of household income must first be estimated. By making those estimates, it is possible to determine if housing unit shortages exist or are projected to exist in Loudoun County for households in selected income ranges. If shortages do exist for households in some ranges, then goals to provide housing to households in those income ranges could then be established.

This section will begin by demonstrating the methodology used to estimate the number of housing units that would be supplied for and demanded by household in various income ranges in Loudoun County. That demonstration will be conducted for the year 2005 and will enable a reader to understand the methodology and assumptions that were used in making these calculations. For this study, however, that analysis was conducted for each of the years between 2005 and 2030. This section will conclude by discussing potential annual affordable housing supply goals.

Methodology Used to Estimate Housing Unit Supply and Demand

The analysis used to estimate housing unit supply and demand for households in various income ranges was conducted using a series of five steps, which are outlined here and described in further detail below:

- Step 1: Estimate the distribution of households in Loudoun County by income range.
- Step 2: Estimate the housing expenditure that a household in each income range could expend without being overly burdened.
- Step 3: Determine the share of households that would demand rental versus owner occupied housing in each income range.
- Step 4: Determine the supply of housing units for both rental and owner occupied housing that would be affordable to each income range.
- Step 5: Compare the supply and demand of housing units by income range to determine where shortages and surpluses exist.

Step 1. Estimate the Distribution of Households by Income Range

Estimating the distribution of households by income in Loudoun County required that ranges of income be identified. The U.S. Department of Housing and Urban Development (HUD) provides annual median family income figures from which analyses of housing cost burden are generally calculated. Typically, that analysis is conducted based on increments of a regional annual median family income such as 10%, 20%, and so forth. In March 2006, HUD estimated the annual median family income for the Washington D.C region to be $90,300.

In estimating the distribution of households by income range in Loudoun County, two adjustments to that figure were required. First, because forecasted data describing the distribution of income in Loudoun County through 2030 are only available by households (as opposed to families), that figure was converted into a household figure. That conversion was conducted by reducing median family income for the region by approximately 12%, the average difference between median household income and median family income among all jurisdictions in the Washington D.C region in 2000. Second, that figure was deflated to 2000 dollars to correspond with available household income data used in this analysis. After those adjustments, the annual median household income (AMI) was assumed to be $67,952.

Data describing the number of households by income ranges were obtained from Woods & Poole, a well known and frequently used private sector source of local socioeconomic data. Those data were adjusted in several ways:

- First, those data were adjusted to agree with the Loudoun County socioeconomic forecast. For example, the projected number of total households in Loudoun County in the Woods & Poole forecast was 164,810 in 2030 versus 163,428 in Loudoun County's socioeconomic forecast. That adjustment, although minor, was considered important so that later comparisons with Loudoun County's housing stock as obtained from Loudoun County's socioeconomic forecast were appropriate.

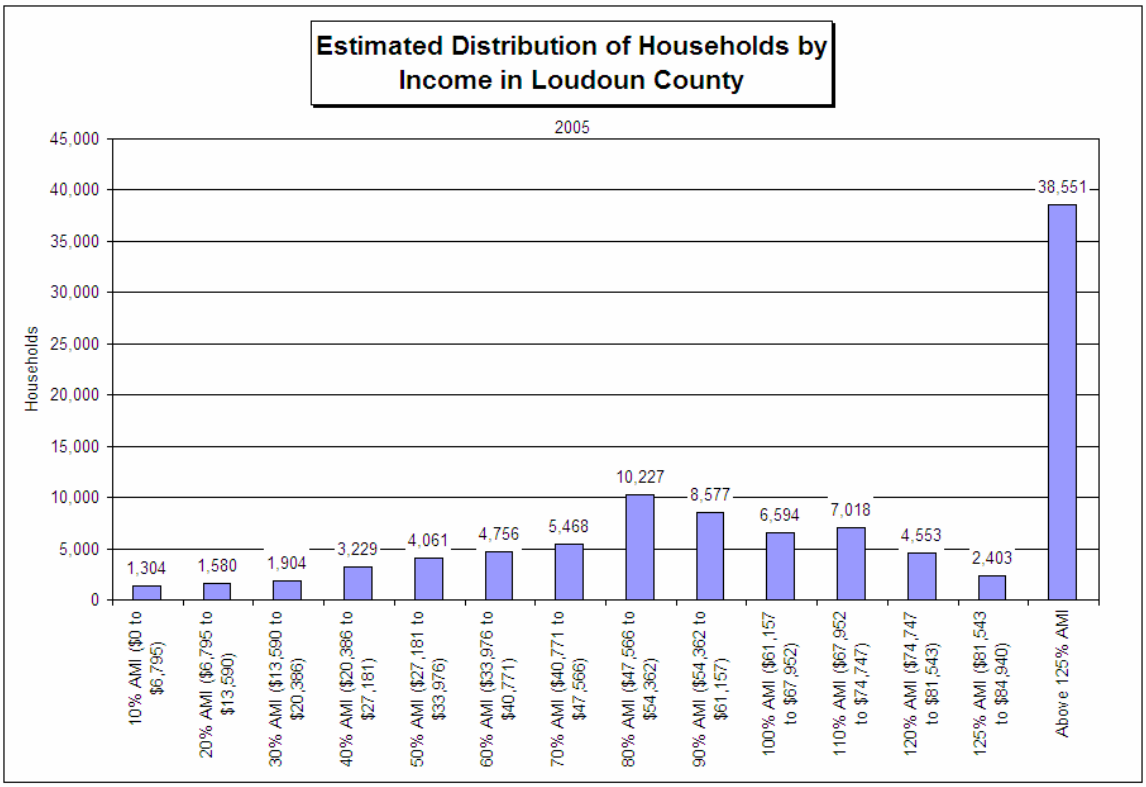
- Second, those data were adjusted to conform to income ranges used by Loudoun County's Department of Family Services. Woods & Poole data are published in income ranges such as $0 to $10,000, $10,000 to $19,999 and so forth. Conversely, Loudoun County's Department of Family Services uses ranges that are relative to regional income such as 10%, 20% and so forth. Making that adjustment required comparing how much of each of the ranges 'overlapped', and then reallocating households based on that comparison.[15]

- Finally, the number of household in each income range was augmented with the additional housing units required to house selected in-commuters, as determined in Question #1. Those households were distributed into income categories based on an estimated level of housing costs that each household could afford. The methodology used to determine the housing costs that each household could afford is discussed in the section entitled Question #2.

[15] That adjustment requires the assumption that households are evenly distributed within each range, which is not likely to be true. However, that assumption does not significantly alter the overall distribution of households by income and therefore is not likely to affect the conclusions of this analysis.

Having made these adjustments, a distribution of households by income range in 2000 dollars for Loudoun County that conformed to income ranges used by the Department of Family Services was produced. That distribution is displayed in Figure 3-1.

Figure 3-1.



Note: Figures are in 2000 Dollars.
Source: Woods & Poole and AECOM Consult, Inc.

Step 2: Estimating Housing Expenditures

Having determined how many households were in each income range, the next step required estimating what a household in each income range could spend on housing without being overly burdened.[16] The monthly housing cost that a household in each of the ranges displayed in the figure above could allocate to housing without being overly burdened was conducted by first taking the midpoint from each income range, then multiplying that figure by 30%, then dividing that figure by 12 (months). Table 3-1 shows the estimated 'affordable' monthly housing costs for a household in each range.

[16] The Census Bureau has reported that a household with housing costs that exceeds 30% of total income is burdened. In addition, the National Association of Realtors reports that the average ratio of income to housing cost is 28%.

Table 3-1. Determining Affordable Monthly Housing Costs

% AMI	Household Income Range	Annual Household Income (Assumed to be at Midpoint of Range)	Affordable Monthly Housing Costs (30% of Annual Income/12)
10%	$0 to $6,795	$3,398	$85
20%	$6,795 to $13,590	$10,193	$255
30%	$13,590 to $20,386	$16,988	$425
40%	$20,386 to $27,181	$23,783	$595
50%	$27,181 to $33,976	$30,578	$764
60%	$33,976 to $40,771	$37,374	$934
70%	$40,771 to $47,566	$44,169	$1,104
80%	$47,566 to $54,362	$50,964	$1,274
90%	$54,362 to $61,157	$57,759	$1,444
100%	$61,157 to $67,952	$64,554	$1,614
110%	$67,952 to $74,747	$71,350	$1,784
120%	$74,747 to $81,543	$78,145	$1,954
125%	$81,543 to $84,940	$83,241	$2,081

Source: AECOM Consult, Inc.

For households at 40% of AMI, it was assumed that their income was $23,783, the midpoint in that range. Also assuming that a household in that range could allocate 30% of its income to housing, it was estimated that the level of expenditures that could be allocated to housing for that household without being overly burdened would be $595 per month. Similarly, a housing unit in the highest income range listed on Table 3-1 could allocate $2,081 to monthly housing expenditures without exceeding the 30% threshold.

Step 3: Determining the Demand for Housing

The next step required that the share of households in each income range that would demand rental units and the share of households in each income range that would demand owner occupied housing needed to be established. That disaggregation was accomplished by reviewing the share of householders that were in rental and owner occupied housing units by income range in the U.S. in 2000.[17] That information is displayed in Table 3-2.

[17] The Census Bureau provides data comparing the share of owners and renters by income range; however, those ranges are in $5,000, $10,000, and $25,000 increments. In order to use that data in this analysis, that information was adjusted to agree with the ranges of incomes used in Table 3-1.

Table 3.2. Shares of Renter and Owner Occupied Housing Units in the U.S. in 2000

% AMI	Share of Households that Rent in the U.S.	Share of Households that Own in the U.S.
10%	63.0%	37.0%
20%	55.6%	44.4%
30%	49.2%	50.8%
40%	44.2%	55.8%
50%	41.2%	58.8%
60%	34.6%	65.4%
70%	33.2%	66.8%
80%	27.7%	72.3%
90%	25.6%	74.4%
100%	23.4%	76.6%
110%	20.0%	80.0%
120%	16.7%	83.3%
125%	16.2%	83.8%
Above 125%	13.2%	86.8%

Source: 2000 Census and AECOM Consult, Inc.

As would be expected, a significantly larger share of households rented housing in lower income ranges than did households in higher income ranges. In fact, in the lowest income range, approximately 63% of households were in renter occupied housing versus 13.2% in the highest range. This disaggregation of households into renter and owner occupied housing was assumed to apply to Loudoun County and was assumed to remain constant from 2005 to 2030.

Having estimated the number of households by income range and the share of households that are likely to demand rental housing versus owner occupied housing at each of those ranges, the number of rental units and owner occupied units that would be demanded by households in each income range in 2005 can be estimated. Those figures are displayed in Table 3-3.

Table 3.3. Estimated Demand for Rental and Owner Occupied Housing by Income Range in Loudoun County

% AMI	Rental Housing Demand	Owner Occupied Housing Demand
10%	822	482
20%	879	701
30%	937	967
40%	1,426	1,803
50%	1,672	2,389
60%	1,644	3,112
70%	1,816	3,652
80%	2,837	7,390
90%	2,194	6,383
100%	1,544	5,050
110%	1,406	5,611
120%	759	3,794
125%	388	2,014
Above 125%	5,094	33,457
Total	**23,419**	**76,806**

Source: AECOM Consult, Inc.

In the lowest income group, an estimated 822 households demanded rental units and 482 demanded owner occupied housing units in Loudoun County in 2005. As would be expected, the figures tend to lean towards owner occupied housing units in higher income ranges. In fact, in the highest income range, it was estimated that approximately 33,000 households demanded owner occupied housing while only 5,100 households demanded rental units in Loudoun County in 2005.

Step 4: Determining the Supply of Housing

Estimating the supply of housing units available to each income range in Loudoun County in 2005 required several steps. First, Loudoun County's housing stock needed to be disaggregated into rental and owner occupied units. Those figures were obtained from Loudoun County's socioeconomic forecast. Based on that forecast, there were 90,640 housing units in Loudoun County, of which 18,705 were rental units and 71,935 were owner occupied units in 2005.

However, in order to compare those figures to demand by income range, the number of housing units that would be affordable to households in each income range needed to be estimated. Those estimates were calculated separately for rental units and owner occupied units.

Rental Units

The number of rental units available to each income range was estimated using several steps. First, the total number of rental units and each unit's rent as published in the Loudoun County Department of Family Services' *Loudoun County Apartment Guide* was compiled.[18] Then, the distribution of units that were affordable for a household in each income range was determined. That distribution was then multiplied by the total number of rental units in Loudoun County based on the socioeconomic forecast. These calculations along with the number of rental units available to households in each income range are contained in Table 3-4.

[18] Rents were deflated to 2000 to be comparable to household by income range data.

Table 3-4. Estimated Number of Rental Units in Loudoun County

% AMI	Affordable Monthly Rent (from Table 3-1)	Rental Units Affordable to Households in Each Income Range in the *Loudoun County Apartment Guide**		Estimated Total Number of Rental Units in Loudoun County**
		Number of Units	Distribution	
10%	$85	0	0.0%	0
20%	$255	0	0.0%	0
30%	$425	0	0.0%	0
40%	$595	62	0.7%	128
50%	$764	82	0.9%	170
60%	$934	550	6.1%	1,139
70%	$1,104	2,114	23.4%	4,377
80%	$1,274	2,352	26.0%	4,870
90%	$1,444	1,561	17.3%	3,232
100%	$1,614	1,140	12.6%	2,360
110%	$1,784	406	4.5%	841
120%	$1,954	739	8.2%	1,530
125%	$2,081	0	0.0%	0
Above 125%	na	28	0.3%	58
Total	**na**	**9,034**	**100.0%**	**18,705**

*Notes: * Figures based on rental unit and inflation adjusted rental cost data obtained in the Loudoun County Department of Family Services'* Loudoun County Apartment Guide. *** Figures were calculated by multiplying the distribution of units by income range times 18,705, the number of rental units in Loudoun County in 2005 based on Loudoun County's socioeconomic forecast.*
Source: Loudoun County Department of Family Services, Loudoun County Department of Economic Development, and AECOM Consult, Inc.

In 2005, a household in the fourth lowest income range (40% AMI) was assumed to be able to pay $595 in monthly rent without being overly burdened. Based on a review of the *Loudoun County Apartment Guide* and estimates of the total number of rental units in Loudoun County in 2005, it was estimated that there were 128 rental units available in that range.

Owner Occupied Units

The number of owner occupied units available to a household in each income range was similarly calculated. First, the number of owner occupied units that sold in 2004 and each unit's sale price was collected from Loudoun County's Department of Financial Services.[19] Then, the distribution of units that were affordable for each income range was calculated. Finally, that distribution was multiplied by the total number of owner occupied units in Loudoun County based on Loudoun County's socioeconomic forecast. These calculations along with the number of owner occupied units available to households in each income range are contained in Table 3-5.

[19] 2004 data were the latest available. Those data were deflated to 2000 to be comparable with household by income range data.

Table 3.5. Estimated Number of Owner Occupied Units in Loudoun County

% AMI	Affordable Monthly Housing Costs (From Table 3-1)	Housing Units Affordable to Households in Each Income Range Based on Observed Sales*		Estimated Total Number of Owner Occupied Units in Loudoun County**
		Number of Units	Distribution	
10%	$85	0	0.0%	0
20%	$255	0	0.0%	0
30%	$425	3	0.0%	16
40%	$595	9	0.1%	49
50%	$764	24	0.2%	131
60%	$934	41	0.3%	225
70%	$1,104	94	0.7%	515
80%	$1,274	220	1.7%	1,205
90%	$1,444	288	2.2%	1,578
100%	$1,614	442	3.4%	2,421
110%	$1,784	576	4.4%	3,155
120%	$1,954	682	5.2%	3,736
125%	$2,081	550	4.2%	3,013
Above 125%	na	10,204	77.7%	55,892
Total	**na**	**13,133**	**100.0%**	**71,935**

*Notes: * Figures based on inflation adjusted housing unit sales price data obtained from the Loudoun County Department of Financial Services*. ** Figures were calculated by multiplying the distribution of units by income range times 71,935, the number of owner occupied units in Loudoun County based on Loudoun County's socioeconomic forecast.*
Source: Loudoun County Department of Financial Services, Loudoun county Department of Economic Development, and AECOM Consult, Inc.

In 2005, a household in the fourth lowest income range (40% AMI) was assumed to be able to pay $595 in monthly housing costs without being overly burdened. Based on a review of inflation adjusted housing unit sales and sales prices in Loudoun County and estimates of the total number of owner occupied units in Loudoun County in 2005, it was estimated that there were 49 owner occupied units available.[20]

Step 5: Comparing Supply and Demand of Housing Units

Having estimated the number of rental and owner occupied housing units that would be demanded by and available to households in each income range, it is possible to compare those figures to determine where surpluses or shortages existed in 2005. Those calculations have been made and are displayed in Table 3-6.

[20] The units available to a household in each income range were estimated based on the mortgage costs related to a 30 year loan with a 7% interested rate.

Table 3.6. Comparison of Housing Unit Supply and Demand

% AMI	Rental Units			Owner Occupied Units		
	Demand (from Table 3.3)	Supply (from Table 3.4)	Surplus / Shortage	Demand (from Table 3.3)	Supply (from Table 3.5)	Surplus / Shortage
10%	822	0	-822	482	0	-482
20%	879	0	-879	701	0	-701
30%	937	0	-937	967	16	-951
40%	1,426	128	-1,298	1,803	49	-1,753
50%	1,672	170	-1,503	2,389	131	-2,257
60%	1,644	1,139	-505	3,112	225	-2,887
70%	1,816	4,377	2,561	3,652	515	-3,137
80%	2,837	4,870	2,033	7,390	1,205	-6,185
90%	2,194	3,232	1,038	6,383	1,578	-4,806
100%	1,544	2,360	816	5,050	2,421	-2,629
110%	1,406	841	-566	5,611	3,155	-2,456
120%	759	1,530	771	3,794	3,736	-59
125%	388	0	-388	2,014	3,013	998
na	5,094	58	-5,036	33,457	55,892	22,435
Total	**23,419**	**18,705**	**-4,714**	**76,806**	**71,935**	**-4,871**

Source: AECOM Consult, Inc.

For rental units, there is a shortage in available units for the lowest six income ranges. In fact, among those ranges, there were an estimated 1,437 units available in 2005 for 7,381 households. It is likely that the surpluses that occurred in the ranges between 70% and 100% of AMI are the result of households in lower income brackets renting units with rents that were beyond that which they could pay without being burdened by housing costs (i.e. more than 30% of their income is allocated towards housing costs).[21]

For owner occupied units, the shortage extends through the lowest twelve income ranges. In fact, among those income ranges, there were an estimated 13,031 units available in 2005 for 41,335 households. Again, surpluses are observed for households in higher income ranges, which are likely due to households selecting residences which require that they expend greater than 30% of their income on housing. Simply put, this analysis suggests that there are a large number of households in owner occupied housing that are 'house poor'.

Estimating Shortages for Selected Income Ranges through 2030

Similar calculations were conducted for selected income ranges in which a shortage was observed (the lowest six ranges for rental units and the lowest twelve ranges for owner occupied units) for all the years between 2005 and 2030. That analysis required that three assumptions be made:

- First, it was assumed that the total number of housing units demanded in Loudoun County was equal to the number of households projected to be in Loudoun County based on Loudoun County's socioeconomic

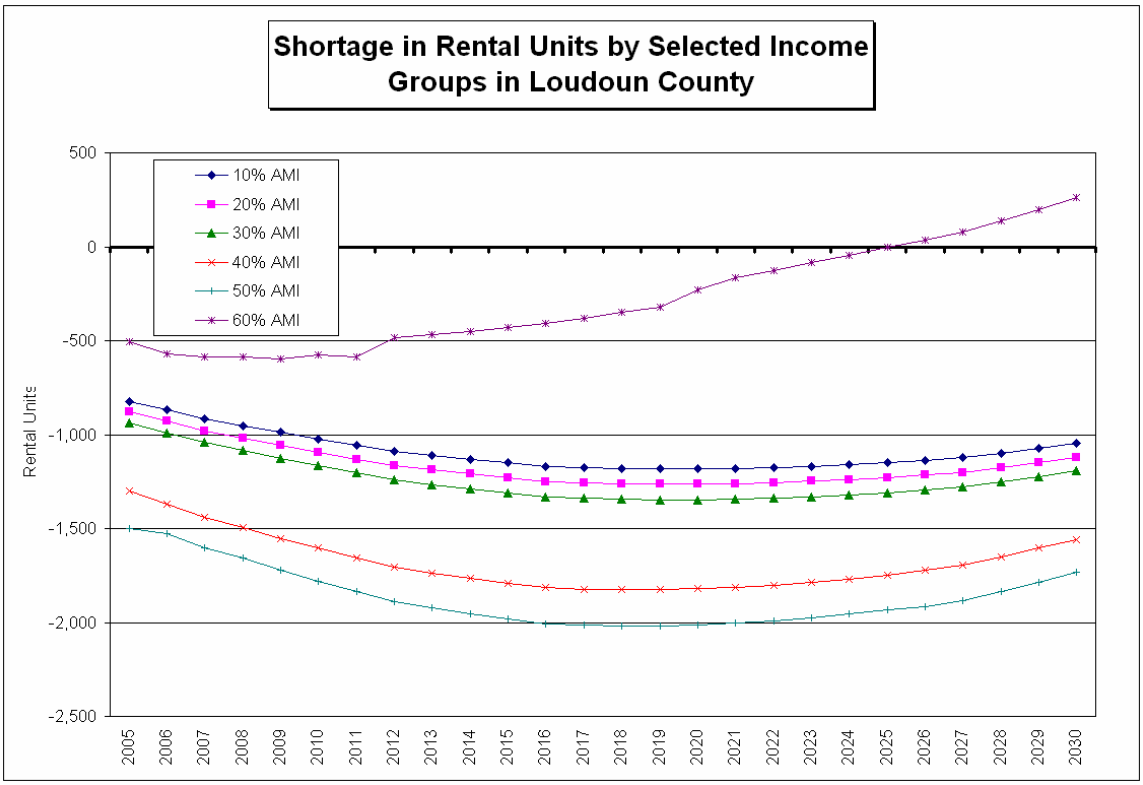
[21] This analysis also indicated that there was a shortage in supply of rental units for households with 110% and 125% of AMI ranges. Because those shortages were not believed to be the focus of this study, they were ignored.

forecast plus the number of housing units required to house selected in-commuters as determined in Question #1.

- Second it was assumed that the share of households demanding a rental unit by income range and the share of household demanding an owner occupied unit by income range as reported in Table 3-2 remained constant throughout the forecast period.
- Finally, it was assumed that the distribution of owner occupied and rental housing units available to each income group as percent of the total as determined in Tables 3-4 and 3-5 remained constant throughout the forecast horizon.

With these assumptions, it is possible to estimate the shortage of housing units for selected income ranges from 2005 through 2030. Shortages for each of those income ranges are displayed for rental units in Figure 3-2 and for owner occupied units in Figure 3-3.

Figure 3-2.

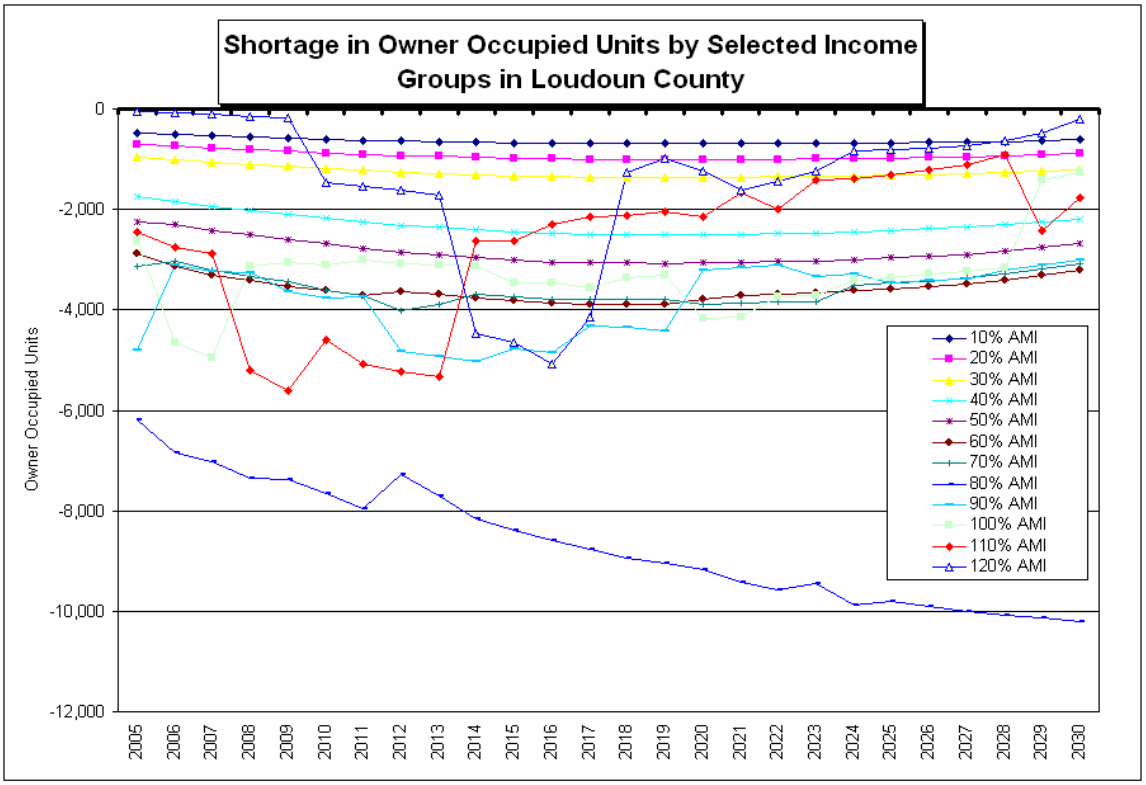


Note: Data are volatile for some income ranges because of the method in which selected in-commuters are allocated to income ranges. As their projected wages change, large numbers of those employees can be reallocated to an alternate income range thereby significantly changing the shortage in housing in that year.
Source: AECOM Consult, Inc.

Between 2005 and 2030, the shortage in available rental units for the lowest five income ranges is projected to worsen. However, in the later years of the forecast, shortages are projected to improve slightly as the share of households in lower income ranges becomes relatively smaller. By 2030, the most severe

shortage is projected to be for households at 50% AMI where about 1,700 more units will be demanded than supplied.

Figure 3-3.



Note: Data are volatile for some income ranges because of the method in which selected in-commuters are allocated to income ranges. As their projected wages change, large numbers of those employees can be reallocated to an alternate income range thereby significantly changing the shortage in housing in that year.
Source: AECOM Consult, Inc.

Similar patterns are observed when examining the shortage in owner occupied housing units for many income ranges over the entire 2005 to 2030 period. Although shortages improve in the later years of the forecast, shortages generally worsen for households in most of the selected income ranges.

Determining an Affordable Housing Goal

Determining a goal to supply affordable housing is dependent upon the extent to which shortages are expected to be met and the period in which those shortages are expected to be met. Thus far, this analysis has identified the shortage in rental and owner occupied units that is projected to occur for each year between 2005 and 2030. Several alternative annual affordable housing unit goals have been generated and are displayed in Table 3-7. Those alternatives involve:

- Providing affordable housing sufficient to not allow shortages to worsen by 2030
- Providing affordable housing sufficient to halve shortages by 2030

- Providing affordable housing sufficient to eliminate shortages by 2030

Table 3-7.

% AMI	Estimated Shortage in 2030		Annual Housing Units Needed to Maintain Shortage Observed in 2005	Annual Housing Units Needed to Halve Shortage by 2030	Annual Housing Units Needed to Eliminate Shortage by 2030
	2005	2030			
Rental Units					
10%	-822	-1,048	9	21	42
20%	-879	-1,120	10	22	45
30%	-937	-1,194	10	24	48
40%	-1,298	-1,559	10	31	62
50%	-1,503	-1,732	9	35	69
Subtotal	**-5,439**	**-6,653**	**49**	**133**	**266**
Owner Occupied Units					
10%	-482	-615	5	12	25
20%	-701	-893	8	18	36
30%	-951	-1,201	10	24	48
40%	-1,753	-2,187	17	44	87
50%	-2,257	-2,688	17	54	108
60%	-2,887	-3,215	13	64	129
70%	-3,137	-3,087	na*	62	123
80%	-6,185	-10,211	161	204	408
90%	-4,806	-3,003	na*	60	120
100%	-2,629	-1,257	na*	25	50
110%	-2,456	-1,770	na*	35	71
120%	-59	-205	6	4	8
Subtotal	**-28,304**	**-30,332**	**238**	**607**	**1,213**

*Note: *Although shortages of owner occupied housing units for households in these income ranges are projected to still exist in 2030, those shortages are projected to have improved by that year.*
Source: AECOM Consult, Inc.

In order to maintain the 2005 shortage of rental units for households in the lowest five income ranges approximately 49 rental units would have to be provided annually for each year between 2006 and 2030. In order to maintain the 2005 shortage of owner occupied units for households in the lowest 12 income ranges approximately 238 owner occupied units would have to be provided annually for each year between 2006 and 2030.

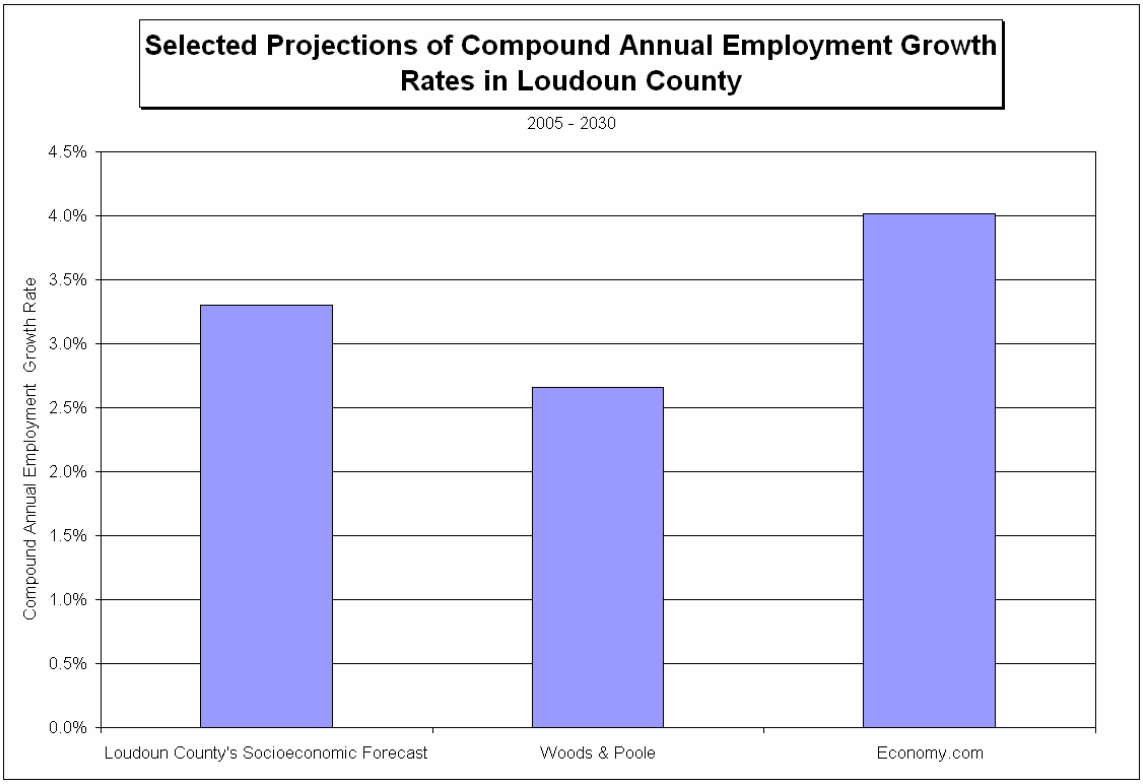
In order to eliminate projected shortages in rental units for the lowest five income ranges, 266 rental units that would be affordable to households in those income ranges would have to be provided annually from 2006 through 2030. Similarly, in order to meet shortages in owner occupied units, about 1,200 units that were affordable to households in the lowest twelve income ranges would have to be provided annually from 2006 through 2030. The large majority of those units would have to be provided for housing units with incomes between 50% and 100% of AMI.

Question #4: What Jobs Are Coming To Loudoun County and What will They Pay?

Loudoun County has had exceptionally strong job growth for several decades. In fact, between 1969 and 2003, Loudoun County's employment increased at a compound annual growth rate of 6.6%. That figure ranked 29th among the nation's 3,100 counties and was far higher than the comparable national average of 1.8% during that period.

Strong rates of employment growth are projected to continue in Loudoun County in the future. Although those figures are projected to be relatively lower than those observed in the past, due to the maturing of the local economy, employment growth in Loudoun County is still likely to outpace the overwhelming majority of U.S. counties in the future. Projected compound annual employment growth rates for Loudoun County from three sources for the 2005 to 2030 period are contained in Figure 4-1.

Figure 4-1.



Source: Loudoun County's Department of Economic Development, Woods & Poole, and Economy.com.

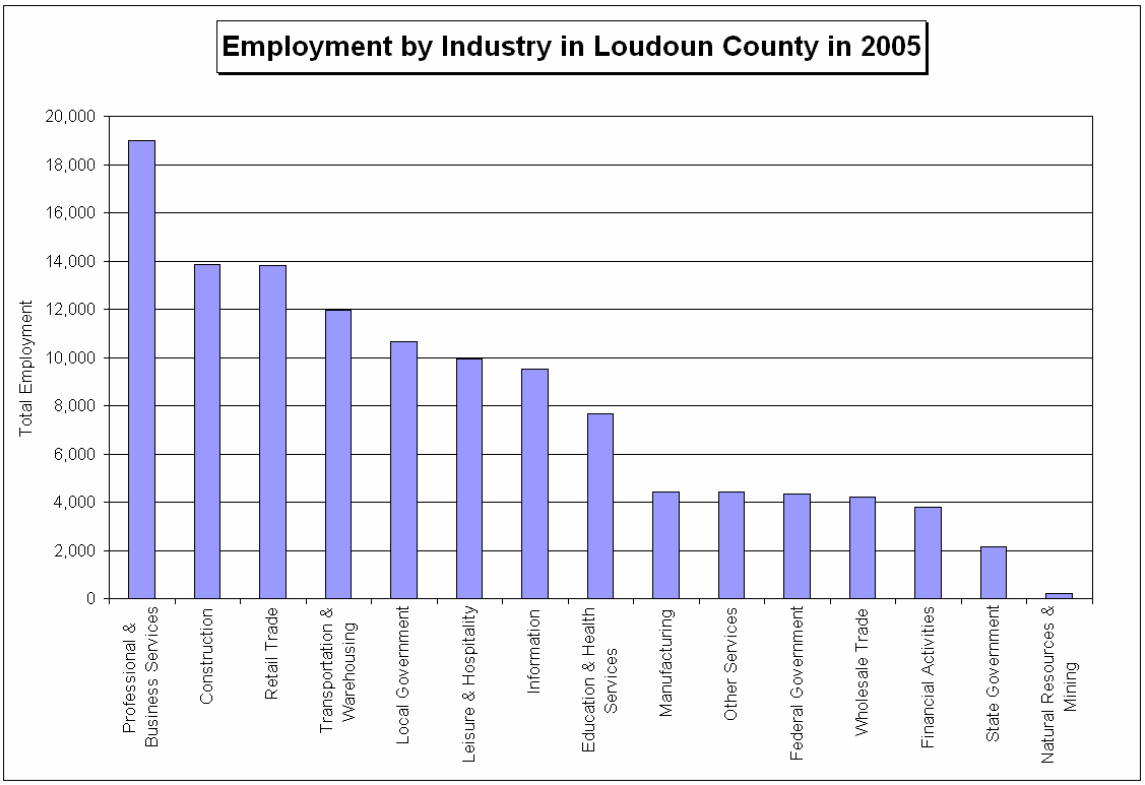
Depending on the source of the forecast, employment growth in Loudoun County is projected to be between 2.7% and 4.0% per year through the next 25 years.

This compares to 1.3% for the Washington D.C. metropolitan area and 1.2% for the U.S.[22]

Employment in Loudoun County by Industry

Loudoun County is fortunate to have an industrial structure that is concentrated in industries that are rapidly growing. Loudoun County's largest industry is professional and business services, employing nearly 19,000 workers in 2005. The construction industry, driven by rapid residential and non-residential growth, was Loudoun County's second largest industry in 2005. Other large industries in Loudoun County include retail trade, and transportation & warehousing. Employment by industry in Loudoun County's is displayed in Figure 4-2.

Figure 4-2.

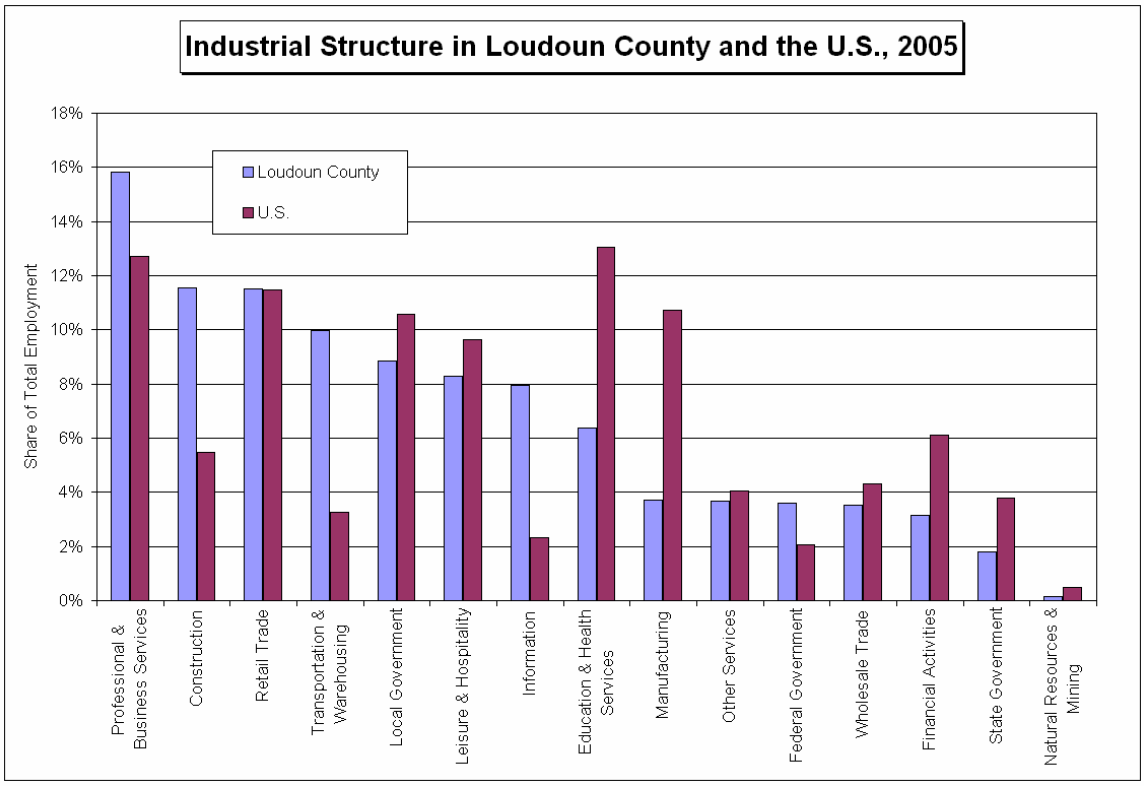


Source: Economy.com.

Comparing Loudoun County's industrial mix with that of the U.S demonstrates where Loudoun County has disproportionately large or small concentrations in each industry. That comparison, which required that employment by industry first be altered to a percentage basis, is displayed in Figure 4-3.

[22] Compound annual employment growth rates for the Washington D.C region and the U.S. were obtained from the Washington Metropolitan Council of Government and the Bureau of Labor Statistics, respectively. Data for the U.S. refer to the period from 2004 to 2014 only.

Figure 4-3.



Source: Economy.com and Bureau of Labor Statistics.

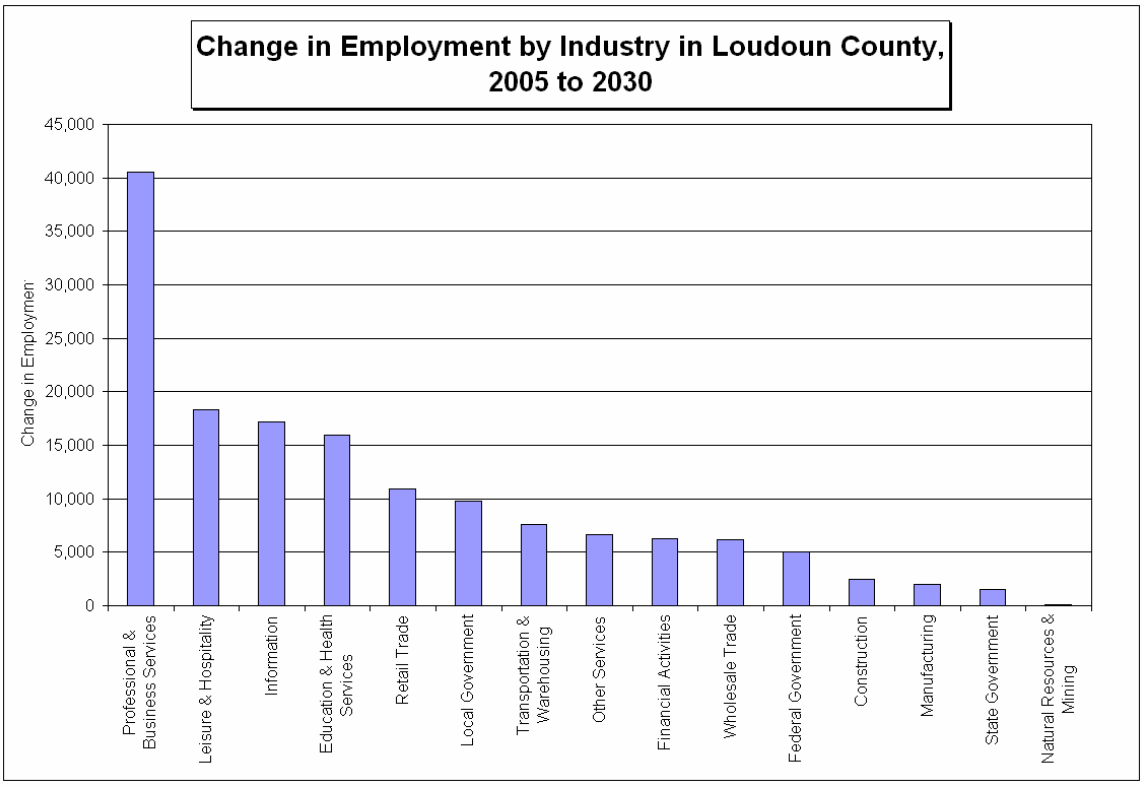
As would be expected, Loudoun County's economy is disproportionately concentrated in professional & business services, construction, transportation & warehousing, information, and federal government employment. A strong concentration in these industries is beneficial as they typically generate high wage jobs.

Projected Employment Changes in Loudoun County by Industry

To determine the jobs that are coming to Loudoun County the distribution of employment as projected in the Economy.com forecast was applied to total employment in Loudoun County's socioeconomic forecast. That methodology was selected because it would allow total employment figures to agree with those officially accepted by Loudoun County local government officials.[23] The change in employment by industry is displayed in Figure 4-4.

[23] Employment and wage figures for transportation & warehousing and federal government published by Economy.com were adjusted to agree with historic figures published by the Bureau of Economic Analysis.

Figure 4-4.



Source: Economy.com and Loudoun County Department of Economic Development.

Between 2005 and 2030, the professional & business services industry is projected to be the largest source of employment growth in Loudoun County. Leisure & hospitality, information, and education & health services are also projected to experience relatively large levels employment growth. In fact, between 2005 and 2030, more than half of all employment growth in Loudoun County is projected to occur in those industries. These figures, along with wages, are summarized after the discussion about wages in Table 4-1 below.

Wages in Loudoun County by Industry

Loudoun County is also fortunate to be relatively concentrated in some high wage industries. For example, wages per worker in Loudoun County's largest industry, professional & business services, were well higher than the all industry average in 2005. Other relatively high wage industries in which Loudoun County had a strong concentration of employment included federal government and information. Strong concentrations in these industries allow Loudoun County to have earnings that exceed averages for many other counties in the U.S. In fact, in 2003, Loudoun County's earnings per worker ranked 67th highest among the nations 3,100 counties. Wages per worker for each industry in Loudoun County for 2005 are displayed in Figure 4-5.

Figure 4-5.

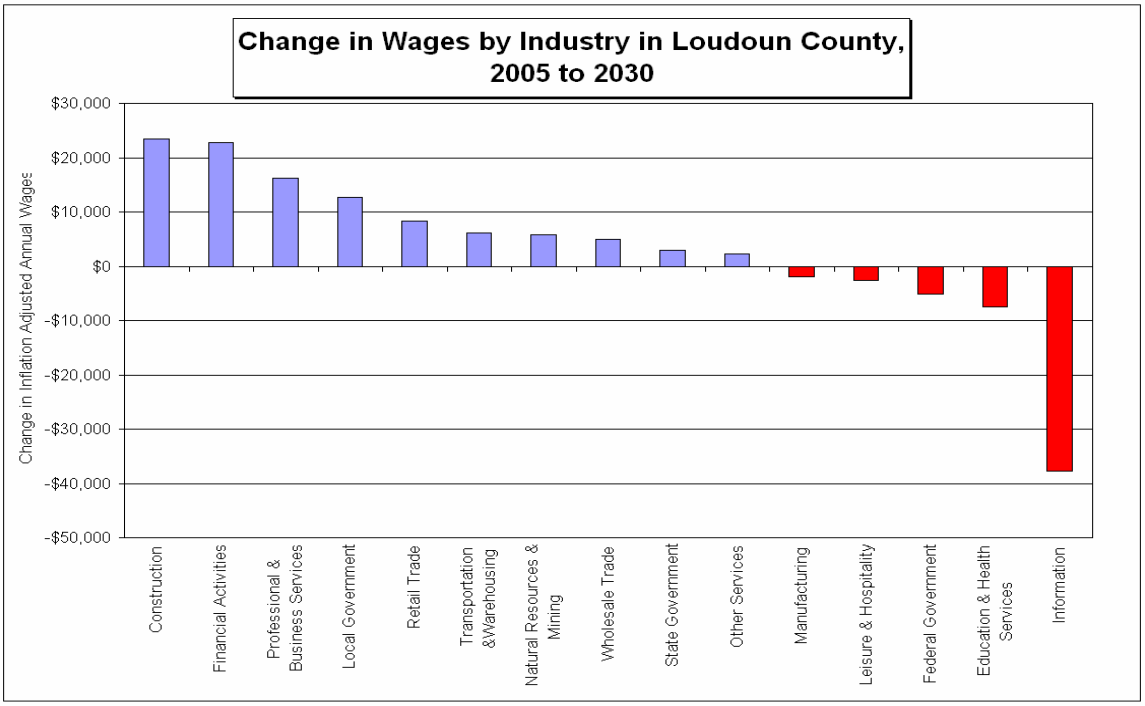
Source: Economy.com.

Wages in Loudoun County's information sector were the highest in 2005, exceeding $100,000 per employee. Federal government, wholesale trade, and professional & business services also had wages above $60,000 per employee.

Projected Wages Changes in Loudoun County by Industry

Prior to analyzing changes in wages in Loudoun County, wage figures were first corrected for inflation. That correction was based on Economy.com's Consumer Price Index (CPI) forecast and allowed wages per worker to be displayed in 2005 dollars. The change in inflation adjusted wages per worker between 2005 and 2030 for each of Loudoun County's industries is displayed in Figure 4-6. In addition, inflation adjusted wages per worker in 2030, along with changes in employment between 2005 and 2030 is displayed in Table 4-1.

Figure 4-6.



Source: Economy.com.

Wages in Loudoun County's construction, financial activities, professional & business services and local government are expected to increase significantly by 2030. Most other sectors are projected to experience relatively small changes in real wages per worker with the exception of information. That sector is projected to experience a substantial decline, falling by about 35% during the period.[24]

Table 4.1. Employment Change in Loudoun County's Between 2005-2030 and wages by Industry

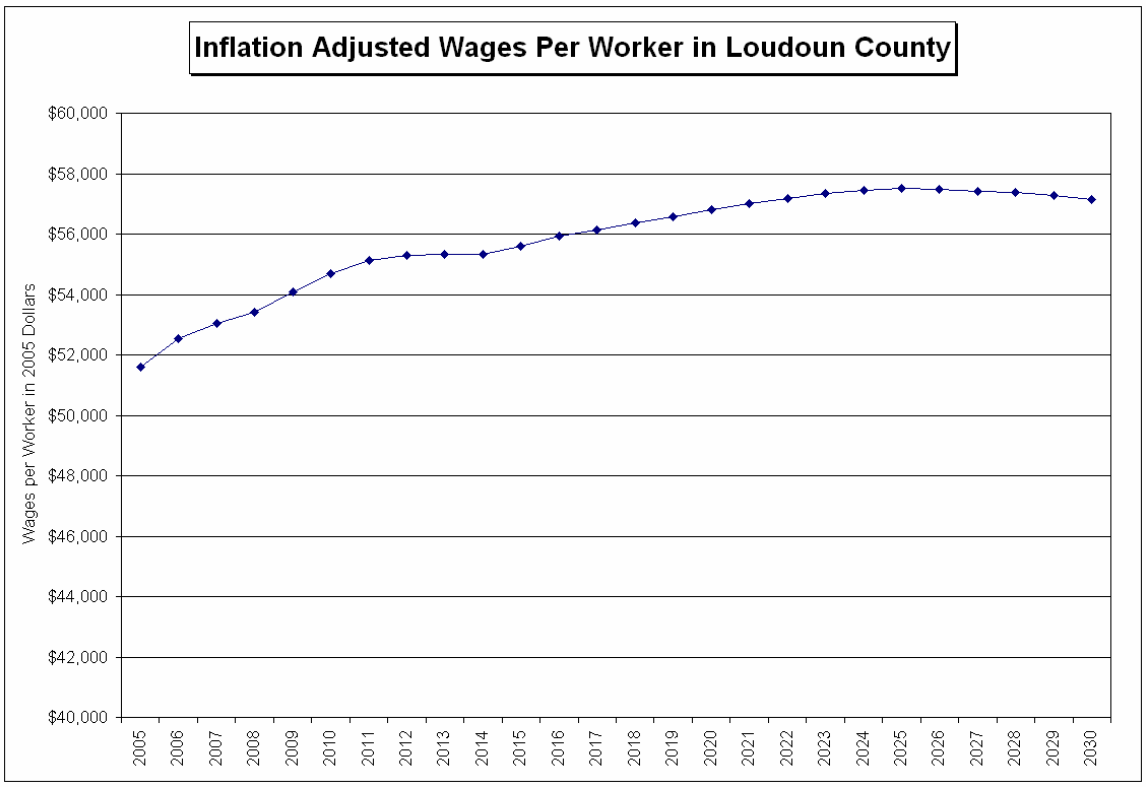
Industry	Employment Change in Loudoun County - 2005 to 2030	Annual Wages in 2030 (in 2005 Dollars)
Professional & Business Services	40,501	$82,772
Leisure & Hospitality	18,310	$14,296
Information	17,145	$66,896
Education & Health Services	15,992	$32,339
Retail Trade	10,962	$33,846
Local Government	9,741	$59,062
Transportation, Warehousing and Utilities	7,617	$52,757
Other Services	6,633	$42,944
Financial Activities	6,294	$81,923
Wholesale Trade	6,143	$74,015
Federal Government	5,041	$89,023
Construction	2,456	$69,738
Manufacturing	1,987	$57,781
State Government	1,501	$21,340
Natural Resources & Mining	99	$25,104

Source: Economy.com and Loudoun County Department of Economic Development.

[24] Economists from Economy.com have indicated that the fall in information wages per worker may be overstated.

Having obtained employment and wage forecasts for each industry in Loudoun County, it is possible to determine what the average wage per employee would be for the 2005 to 2030 period. That calculation has been made and is displayed in Figure 4-7.

Figure 4-7.



Source: Economy.com.

Earnings per worker are projected to increase by about 10% over the entire 2005 and 2030 period, after being adjusted for inflation, increasing from about $52,000 in 2005 to $57,000 in 2030. Minor declines in inflation adjusted wages per worker projected to occur in the last few years of the forecast period are related to relatively strong growth in sector such as information and leisure & hospitality, each of which are projected to experience modest decline in inflation adjusted earnings per worker in those years.

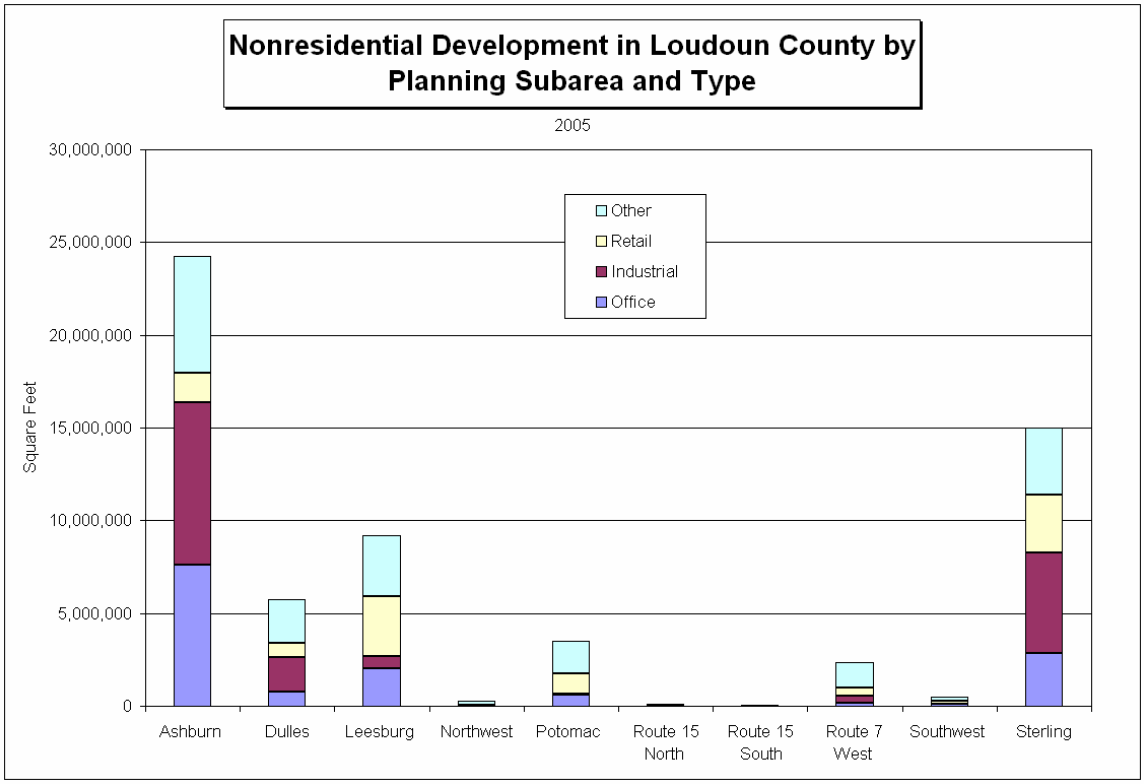
Determining the Location of Employment Growth by Planning Subarea

Based on Loudoun County's socioeconomic forecast, about 150,000 employees will be added to Loudoun County's economy between 2005 and 2030. Assuming that employment locates in planning subareas similar to that which has historically occurred, the location of that employment within Loudoun County, by planning subarea, can be estimated by:

- First determining the existing distribution of nonresidential development by type of development (i.e. office, industrial, retail, other) in Loudoun County
- Then determining the type of development that the increase in jobs that are projected to locate in Loudoun County will be in
- And finally by applying those jobs to subareas based on existing distributions of nonresidential development by type.

Based on 2005 data, the largest concentration of nonresidential development was in Ashburn and Sterling. In fact, nearly two thirds of all nonresidential development was concentrated in those areas. The nonresidential development by type of development and planning subarea is displayed in Figure 4-8.

Figure 4-8.



Source: Loudoun County's Department of Economic Development.

The Metropolitan Washington Council of Governments (MWCOG) has identified a matrix that allows employment by industry to be converted into employment by type of development. For example, that matrix indicates that 20% of manufacturing employment typically locates in office development, 70% in industrial development, and 10% retail development. By applying that information to the projected employment growth in Loudoun County by industry type, the type of development that would be required for increased employment can be estimated. Table 4-2 displays the increase in employment projected to occur in Loudoun County between 2005 and 2030 by development type.

Table 4-2. Employment by Type of Development

Industry	Office	Industrial	Retail	Other	Total
Natural Resources & Mining	20	69	10	0	99
Construction	491	1,719	246	0	2,456
Manufacturing	397	1,391	199	0	1,987
Wholesale Trade	123	5,222	799	0	6,143
Retail Trade	548	0	10,414	0	10,962
Transportation, Warehousing and Utilities	4,951	2,666	0	0	7,617
Information	10,287	857	2,572	3,429	17,145
Financial Activities	5,350	0	944	0	6,294
Professional & Business Services	24,301	2,025	6,075	8,100	40,501
Education & Health Services	9,595	800	2,399	3,198	15,992
Leisure & Hospitality	10,986	916	2,747	3,662	18,310
Other Services	3,980	332	995	1,327	6,633
Federal Government	4,537	252	0	252	5,041
State Government	676	150	0	676	1,501
Local Government	4,384	974	0	4,384	9,741
Total	**80,625**	**17,372**	**27,398**	**25,027**	**150,423**

Source: Loudoun County's Department of Economic Development, Economy.com, and MWCOG.

Assuming the nonresidential development associated with the projected employment growth in Loudoun County by planning subareas follows the pattern of nonresidential development that has historically occurred, then employment by planning subarea can be estimated. Those estimates are displayed in Table 4-3.

Table 4-3. Employment by Type of Development

Planning Subarea	Office	Industrial	Retail	Other	Total
Ashburn	43,557	8,866	4,146	8,173	64,742
Dulles	4,413	1,868	2,031	3,049	11,361
Leesburg	11,676	630	8,546	4,264	25,116
Northwest	25	23	82	311	441
Potomac	3,327	63	2,834	2,323	8,547
Route 15 North	6	7	19	106	138
Route 15 South	0	15	46	52	113
Route 7 West	896	392	1,158	1,738	4,183
Southwest	551	18	361	291	1,221
Sterling	16,175	5,489	8,173	4,722	34,560
Total	**80,625**	**17,372**	**27,398**	**25,027**	**150,423**

Source: Loudoun County's Department of Economic Development, Economy.com, and MWCOG.

Based on this analysis, the largest share of employment is likely to locate in Ashburn. A large majority of that development would be office based; however, there would be a significant amount of industrial and other employment in that subarea. Other planning subareas projected to experience relatively large levels employment growth include Sterling, Leesburg, and Dulles.

Question #5: What is an Acceptable Commuting Distance?

The acceptability of a commute can be influenced by factors such as wages, geographic characteristics, family composition, number of workers per household, industry, sex of the commuter, and many other factors. In addition, because of the impact that congestion can have on commute times, the acceptability of a commute is likely measured in minutes as opposed to miles.[25] For that reason, this section will address the acceptability of a commute based in minutes as opposed to distance.

There have been several empirical studies that have discussed the extent to which drivers would be willing to commute. In those studies, acceptable commuting times are generally described to be in a range between 30 and 45 minutes for a one-way commute. A selected number of studies that discuss acceptable commuting distances are outlined below.

Washington D.C. A poll of 1,003 randomly selected adults in the Washington area and 1,204 adults nationwide was conducted by the Washington Post in 2005 (Morin and Ginsburg, 2005). That survey determined that half the region's workers spent 30 or more minutes commuting to work. Further, that study stated that commute times in the Washington D.C area were significantly higher than those found in other major metro areas. Despite the relatively high travel times and the availability of alternative transportation, that study concluded that commuters seemed unwilling to give up personal autos as their primary commuting transportation mode.

San Diego. In 2004, the *San Diego Source* reported that, based on a 2004 survey of real estate professionals, 30 minutes appeared to be an acceptable commuting time for many home buyers in the San Diego area (Mallgren, 2004).

Southern California. A 1993 University of California study of commuting patterns of 30,000 Kaiser Permanente employees over the six year period between 1984 and 1990 concluded that 93.8% of respondents with a commute of 32 minutes or less were satisfied or very satisfied with their distance from home to work (Wachs et al, 1993). In addition, 46.5% of respondents with a commute time of more than 32 minutes were satisfied or very satisfied with their distance to work. The authors also noted that the majority of respondents, about 66%, had commute times of less than 35 minutes and described that commute time as "manageable".

United Kingdom. A 2001 study conducted by United Kingdom's Department for Work and Pensions surveyed 1,100 adults for different aspects of job search flexibility (Bonjour et al, 2001). A summary of their responses is presented in Table 5-1.

[25] Commute times refer to the average number of minutes that are spent making a one way trip between home to work in a particular area.

Table 5-1. Acceptable Commute time in the U.K.

Acceptable Commuting Time, One Way	Male	Female	Total	
			Persons	Percent
Up to 30 minutes	237	322	559	50.1%
31-60 minutes	268	169	438	39.2%
More than one hour	49	13	61	5.5%
Other	17	42	59	5.3%
Total	**571**	**546**	**1,117**	**100.0%**

Source: Bonjour, Dorsett, and Knight, 2001.

Among these findings was that more than half of respondent indicated that a commute time of 30 minutes was acceptable and an additional 39.2% of respondents indicated that a commute time of up to 60 minutes was acceptable. This suggests that a reasonable estimate for an acceptable commute time would be between 30 and 60 minutes.

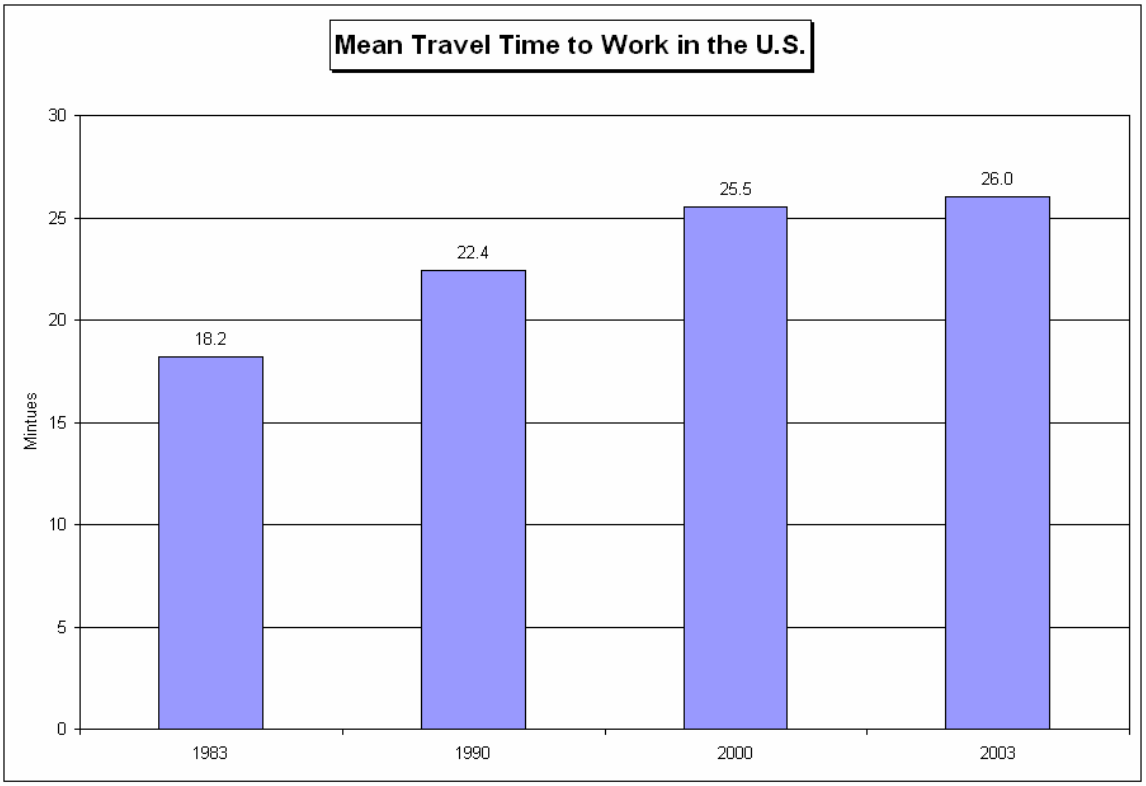
Denmark. In a 2001 study of unemployment conducted by Denmark's Institute for the Study of Labor, approximately 5,000 working age adults in the EU were surveyed (Pederson and Smith, 2001). In that survey, respondents were asked what their maximum acceptable daily commuting time would be in minutes. The average of all respondents was 60 minutes (i.e. 30 minutes per direction).

Other academic research agrees with these general findings. For example, in *Spatial Flexibility and Job Mobility: Macro Level Opportunities and Micro Level Restrictions*, the author states that most people's commuting tolerance is limited to 45 minutes (Van Ham et al, 2001). These findings support the assumption that an acceptable commuting time may be approximately 30 minutes while a tolerable commuting time may be upwards of 45 to 60 minutes at the maximum.

Commute Time in the U.S.

A review of historic data describing the U.S. mean travel time to work demonstrates that commuting times are increasing in the U.S. In fact, the mean travel time to work has steadily increased from 18.2 minutes in 1983 to 26 minutes in 2003. That represents a 35% increase over the period of twenty years. If that pace were to continue, the mean travel time to work in the U.S. could approach 40 minutes by 2030. Mean travel time to work in the U.S. is displayed in Figure 5-1.

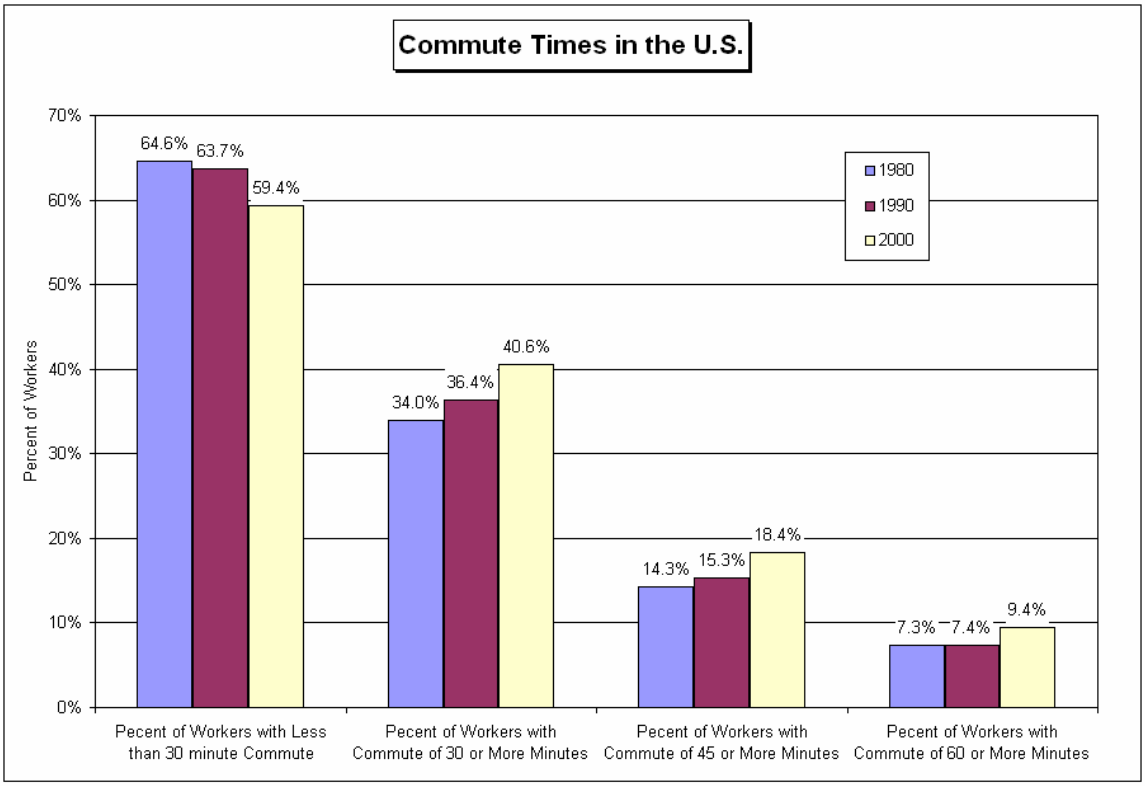
Figure 5-1.



Source: Federal Highway Administration and U.S. Census Bureau

Over time, the share of U.S. commuters with commute times of 30 minutes and more has increased as the share of commuters with a commute time of less than thirty minutes has diminished. In 1980, about a third of workers had a commute that was more than 30 minutes, a figure that increased to over 40% by 2000. Additionally, the number of commuters with very long commutes, in excess of one hour one way, increased significantly in 2000. In 1980, only 7.3% of commuters had a one hour commute. That figure increased to 9.4% in 2000. Changes in the share of commuters in the U.S. with commutes of less than 30 minutes, more than 30 minutes, more than 45 minutes, and more than one hour are displayed in Figure 5-2.

Figure 5-2.

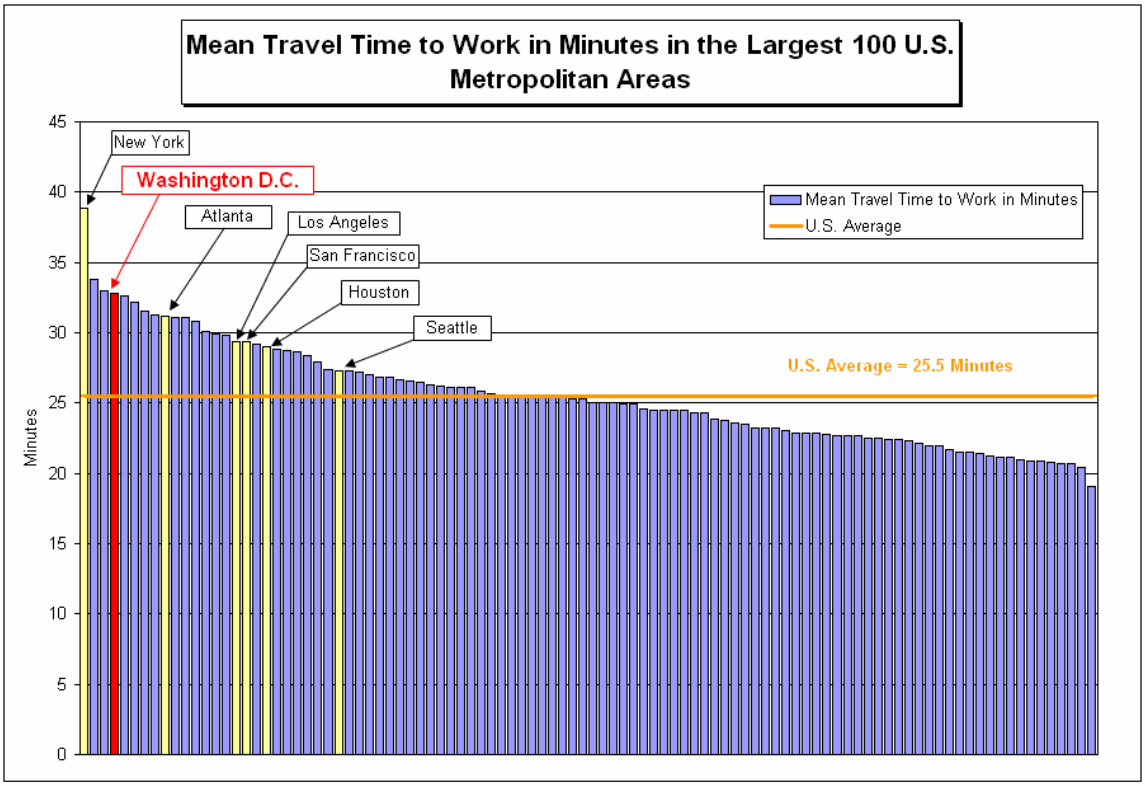


Note: Figures do not sum to 100% because some respondents are included in multiple groups.
Source: Federal Highway Administration

Average Commute Time in the Washington Metropolitan Area

Relative to other large metropolitan areas in the U.S, commuting time is relatively high in the Washington D.C. area. In fact, among the nation's largest 100 Metropolitan areas in terms of population, Washington's mean travel time to work in 2000 was 4th highest behind only New York City, Monmouth-Ocean, NJ, and Nassau-Suffolk, NY. Mean travel times in Washington were higher than other metro areas that are frequently described as having difficult commutes including Atlanta, Los Angeles, San Francisco, Houston, and Seattle. The mean travel time to work in Washington D.C. and the nation's 100 largest metro areas is displayed in Figure 5-3.

Figure 5-3.



Source: 2000 Census

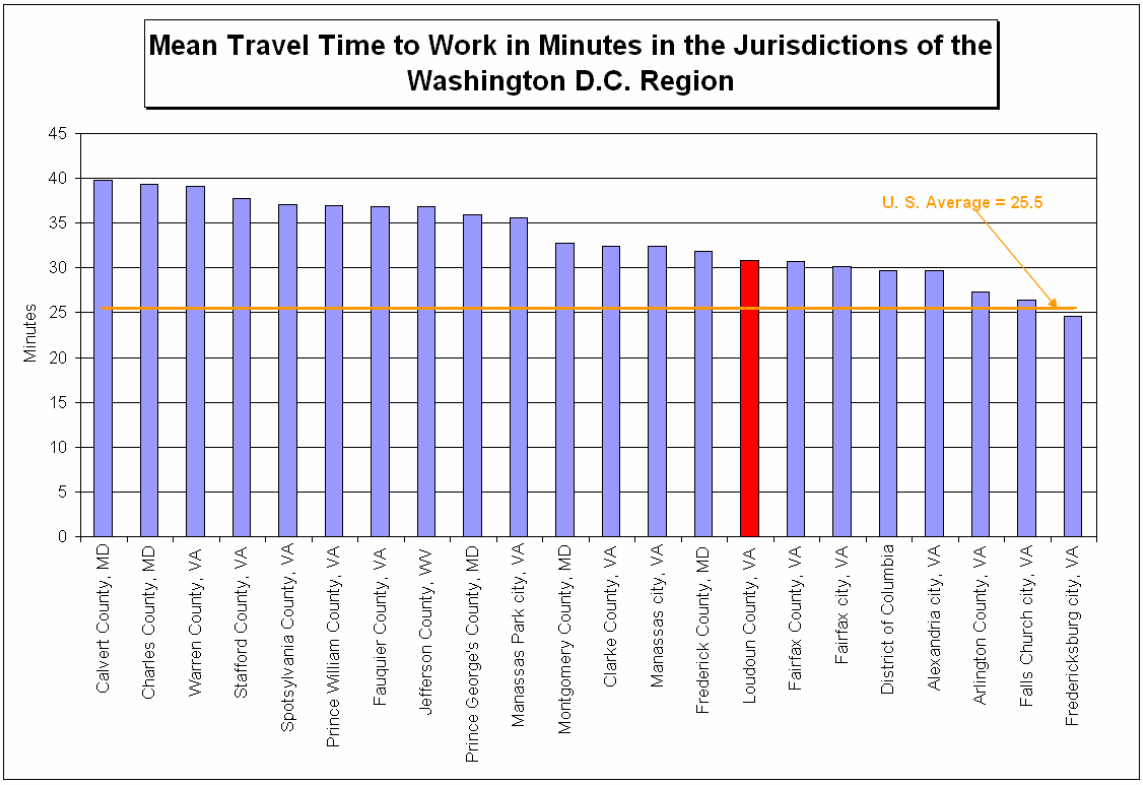
Washington's relatively high commuting times are not likely to have improved since 2000. Based on the Metropolitan Washington Council of Governments' (MWCOG) periodically produced commuting survey, commuting times in the Washington region increased from approximately 32 minutes to 34 minutes between 2001 and 2004.[26] Among respondents reporting that their commute had worsened, an overwhelming majority (81%) indicated that their commute was more difficult because their route was more congested.

Average Commute Time in Loudoun County

Loudoun County residents, along with other residents of the Washington Metro area also faced disproportionately high commuting times in 2000. In that year, the mean travel time to work in Loudoun County was 30.8 minutes. That figure was relatively low among Washington Metro area jurisdictions, however, it is important to note that all jurisdictions in the Washington area with the exception of Fredericksburg City had mean travel times that were above the U.S. average in 2000. Loudoun County's mean travel time to work is compared to similar figures for Washington Metro area jurisdictions in Figure 5-4.

[26] That report is entitled *State of the Commute.* The most recent edition was published in 2004 and included results from a survey of 7,200 employed persons in the Washington Metro Area.

Figure 5-4.



Source: 2000 Census

By virtually any comparison, commute times as measured by the average travel time to work for Loudoun County residents, were relatively high in Loudoun County in 2000. Loudoun County's mean travel time to work has been compared with a number of different sets of counties and in each case Loudoun County's commute times are in the top third and in some cases, near the top decile. Commuting time comparisons are displayed in Table 5-2.

Table 5-2. A Comparison of Loudoun County's Mean Commute Time

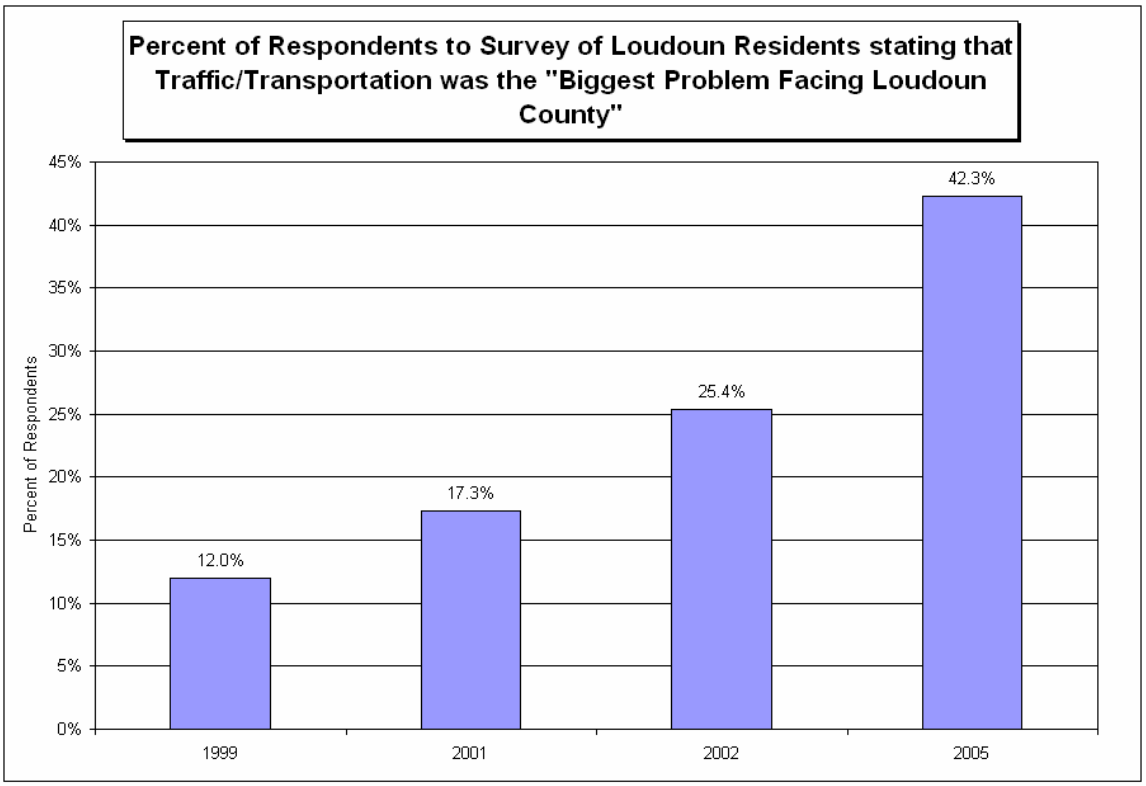
Comparison Set	Rank of Loudoun County's Mean Time to Work	Percentile Among Set of Counties
Virginia Counties	41st	30.4%
Fastest Growing 100 Counties (2000-2005)	29th	29.0%
500 Largest Counties (as measured by 2000 population)	50th	10.0%
All 3,141 U.S. Counties	332nd	10.6%

Note: A rank of 1 suggests that the commute time as measured in minutes, is the longest.
Source: 2000 Census

Unfortunately more current data relating to Loudoun County's commuting times are unavailable, however, given the rapid pace of housing construction and employment growth that has occurred in Loudoun County and other exurban counties since 2000, it is likely that commuting times have worsened. This conclusion is supported by information obtained in the periodic *Survey of Loudoun County Residents*.

The *Survey of Loudoun County Residents* is typically produced every two years. Respondents are asked questions related to issues such as their reasons for moving to Loudoun County, their opinion of the quality of county services and other characteristics. Particularly important to this study is the question that asked respondents to identify the "biggest problem facing Loudoun County." Not surprisingly, responses to this question have historically been related to growth. However, transportation and traffic issues have become increasingly common as a response in that survey. The share of respondents that selected traffic and transportation as one of the biggest problems facing Loudoun County is displayed in Figure 5-5.[27]

Figure 5-5.



Source: Loudoun County Department of Economic Development.

Currently, at 30 or more minutes, Loudoun County commuters are likely at the high end of a range viewed as acceptable. This finding may be even more applicable to in-commuters working in Loudoun County as they may be commuting from other jurisdictions in the region or from jurisdictions in West Virginia or other exurban locations.

[27] Respondents were allowed to select more than one problem in that survey.

Appendix A. Adjustments to Employment Data

In conducting the analysis related to Question #1, employment by place of work was compared to employment by place of residence for Loudoun County and for the set of peer counties. However, the data used in that analysis required several adjustments. This appendix will describe those data sources and the adjustments that were implemented.

Employment by place of work

Employment by place of work data were obtained for Loudoun County and each peer county from the Bureau of Economic Analysis' (BEA) Regional Economic Information System for the year 2003. Those data were available for each of the counties analyzed in this study. However, in some cases, employment in particular industries was suppressed to protect the identity of large employers. Incidents of suppression were most common among agricultural and mining industries. For that reason, and because these industries are very small as a percent of total employment, those industries were not included in the analysis conducted in Question #1.

The suppression of data in other industries required that employment for suppressed industries needed to be estimated. In order to estimate those data, the number of employees from each industry for which data was provided was subtracted from total employment for each area to determine the total number of employees that were in industries that were suppressed. Then those employees were allocated to the suppressed industries based on the national distribution of employment. It is important to note that less than 3.5% of employment was reallocated in this manner in Loudoun County and the set of peer counties.

Employment by place of residence

For this analysis, data describing employment by place of residence was obtained from the 2000 Census. Those data were adjusted in three ways.

- First, given the significant changes that have occurred in Loudoun County since 2000, it was decided to adjust those data to reflect a more current period.
- Second, given that data by place of residence include self-employed workers and data by place of work do not, data by place of residence were adjusted to remove self-employed workers in order to enable fair comparisons.
- Finally, data describing government employment were disaggregated into differing levels of government (i.e. federal, state, and local).

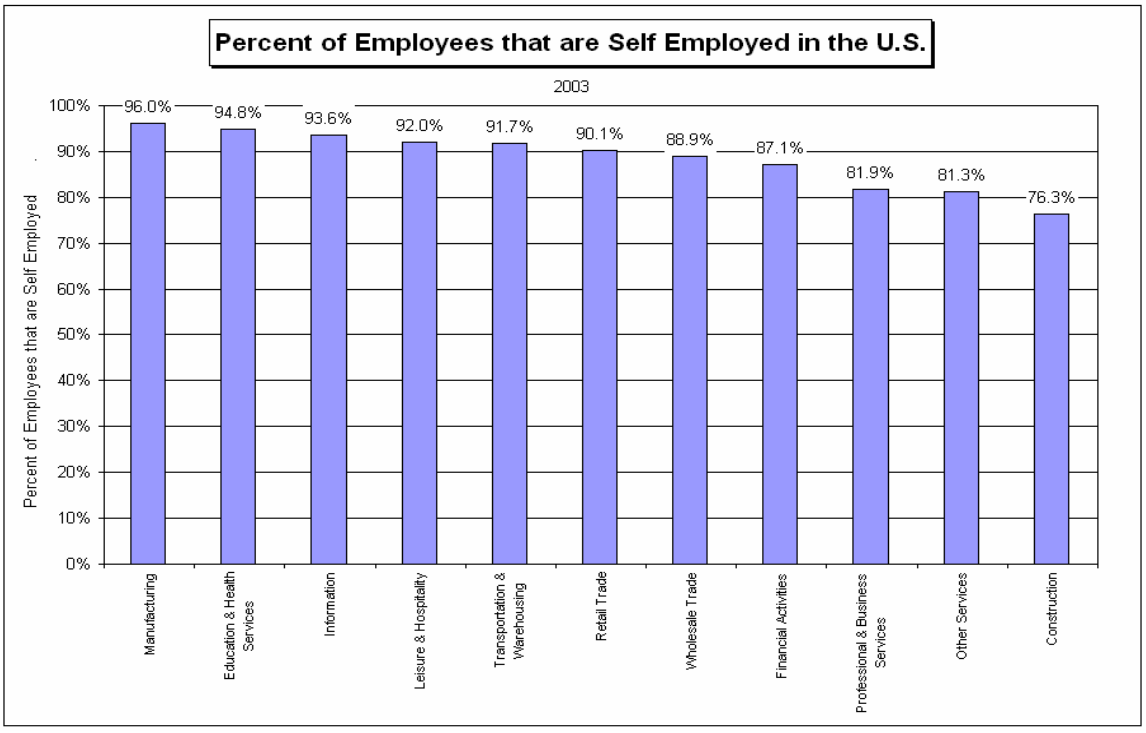
These adjustments are described in more detail below.

The first adjustment to employment by place of residence involved the updating of that data to reflect changes that have occurred since 2000. Because the latest year for which data was available for each of the peer counties was 2003, that year was selected as the year in which analysis related to Question #1 would be conducted.

Employment by place of residence data were adjusted to 2003 using employment growth trends observed at the metropolitan level for each of the peer counties and for Loudoun County. Data describing employment by place of work was obtained from the Bureau of Economic Analysis for peer Counties. Changes in the shares of employment for each metropolitan level were then applied to shares of employment by place of work. Then, using updated shares and 2003 employment by place of residence estimates provided by the Bureau of Labor Statistics for Loudoun County and each peer county, 2003 employment by place of residence figures were estimated for Loudoun County and each peer county.

The second adjustment involved correcting employment by place of residence for self employment. That adjustment was conducted by first determining the share of employees that were self employed in each industry in the U.S. and then adjusting employment data for each industry by place of residence in Loudoun County and peer counties by that factor. The share of employees that are self employed in each industry in the U.S. in 2003 is displayed in Figure A.1.

Figure A.1.



Source: Current Population Survey, 2003.

The number of employees by place of residence excluding self employed was calculated by multiplying the total estimated employment by place of residence for each industry in 2003 times shares of employees in each industry that are self employed as displayed in Figure A.1.

The final adjustment required that government employment by place of residence be disaggregated into differing levels of government. The Census 2000 place of work data contain the number of workers employed by the government but do not disaggregate that employment by level of government. Therefore, the number of workers in each level of government by place of residence was calculated by multiplying the total number of employees in government by place of residence (as estimated for 2003) times the share of employment in each level of government in each peer county's metropolitan area.

Appendix B. Industry Descriptions

Industry descriptions were provided for each industry analyzed in this report and included characteristics such as the relative size in employment in the U.S., projected national growth, and relative U.S. earnings. This information was obtained primarily from the Bureau of Labor Statistics' *Industry at a glance* profiles, available at http://www.bls.gov/iag/iaghome.htm. Discussion of wages relative to all industry averages refer to production and non-supervisory hourly wages in comparison to all private industries. Factors such as overtime and benefits are not included in those comparisons.

Natural Resources and Mining. This industry is comprised of the agriculture, forestry, fishing, and hunting sector and the mining sector. In 2004, wages in this industry were 15% higher than the all U.S. industry average. In 2005, this industry was the nation's smallest industry, employing 625,000 employees. Employment is projected to decline by 10.7% in the agriculture, forestry, fishing and hunting sector and 8.8% in the mining sector between 2004 and 2014.

Construction. The construction industry includes establishments engaged in the preparing of sites for construction, subdividing land, and the construction of building and other projects. In 2004, U.S. construction wages were 23% higher than the all U.S. industry average. In 2005, construction was the nation's eighth largest industry, employing 7.2 million employees. Employment in construction is projected to increase by 11.4% in the U.S. between 2004 and 2014, slightly less than the all industry average of 14.8%.

Manufacturing. This industry includes establishments engaged in the mechanical, physical, or chemical transformation of materials into new products. In 2004, manufacturing wages in the U.S. were 3% higher than the all industry average. In 2005, manufacturing was the nation's fourth largest industry, employing 14.2 million employees. Employment in this industry is projected to decrease by 5.4% between 2004 and 2014, continuing its steady decline.

Retail and Wholesale Trade. Retail establishments include both store (i.e. retailers with a physical location) and non-store establishments (i.e. retailers that market goods through catalogs, vending machines, and the Internet). Retail establishments distribute merchandise, generally in small quantities, to the general public. Wholesale establishments include those that are engaged in the resale of goods, generally without transformation and typically sell to other wholesalers or retailers.

Wages in retail in the U.S. are typically low, averaging 77% of the all industry wages in 2004. However wholesale wages were 13% higher than the all industry average in that year. In 2005, retail and wholesale trade were the nation's third and ninth largest industries, employing 15.2 million and 5.7 million employees, respectively. The retail and wholesale trade industries are projected to

experience an employment growth rate of 11.0% and 8.4% in the U.S. over the 2004 to 2014 period, each lower than the all industry average of 14.8%.

Transportation, Warehousing and Utilities. Transportation & warehousing includes establishments that provide transportation services for cargo and passengers and warehousing and storage for goods. Utilities establishments are engaged in providing electric power, natural gas, steam and water supply, and sewage removal.

Wages in transportation & warehousing were 5% higher than the all industry average in 2004 while wages in utilities were 63% higher than the all industry average. In 2005, transportation, warehousing, and utilities was the nation's eleventh largest industry, employing 4.3 million employees. Transportation & warehousing is projected to experience an employment growth rate of 11.9% over the 2004 to 2014 period, slightly lower than the all industry average of 14.8%. Employment in utilities is projected to decline by 1.3% in that period.

Information. This industry includes establishments engaged in:

- Producing or distribution information such as newspapers or publishers
- Providing a means to transmit information, data, and communications such as telecommunications or Internet service providers
- Data processing, hosting or related services.

In 2004, wages in information in the U.S. were 37% higher than the all industry average. In 2005, information was the nation's twelfth largest industry, employing 3.1 million employees. Nationally, employment in information is projected to increase by 11.6% between 2004 and 2014, slightly below the all industry average of 14.8%.

Financial Activities. This industry is comprised of two parts including:

- Finance and insurance, which includes establishments engaged in or facilitating financial transactions
- Real estate and rental and leasing, which includes establishments that rent or lease assets or manage real estate for others including the buying, selling and renting of properties.

In 2004, U.S. wages in this sector were 12% higher than the all industry average. In 2005, information was the nation's seventh largest industry, employing 8.2 million employees. Employment in financial activities is projected to increase by 10.5% between 2004 and 2014, slightly below the all industry average of 14.8%.

Professional & Business Services. Professional & business services is comprised of three parts:

- Professional scientific, and technical employment such as legal, engineering, computer, consulting, and research services
- Management of companies and enterprises, such as establishments that hold securities of other companies or companies that administer, oversee, and manage other companies
- Administrative, and support and waste management and remediation services, which includes companies that administer day to day activities for other companies such as administration, hiring, clerical work, security, and waste disposal services.

Wages in professional & business services in the U.S. were 11% higher than the all industry average wage in 2004. In 2005, professional & business services was the nation's second largest industry, employing 16.9 million employees. This industry is projected to experience employment growth of 27.8% in the U.S. between 2004 and 2014.

Education & Health Services. This industry is comprised of two parts including educational services and health care and social assistance. Educational services includes establishments that provide training and instruction such as schools, colleges, universities, and training centers. Only privately owned establishments are included in this category. Publicly owned establishments such as public schools are included in local government. Health care and social assistance includes establishments providing medical care and family, community, and day care services.

In 2004, wages in education and health services were 3% higher than the all industry average. In 2005, education and health services was the nation's largest industry, employing 17.3 million employees. Nationally, employment is projected to increase 32.5% and 30.3% between 2004 and 2014 for education services and health care and social services respectively, each of which far exceeds the all industry average of 14.8%.

Leisure & Hospitality. The leisure & hospitality industry is made up of two parts including:

- Arts, entertainment, and recreation, which includes establishments that provide or promote live performances or events, preserve and exhibit objects or sites of interest, or operate facilities that allow patrons to participate in recreational activities
- Accommodation & food services includes establishments that provide patrons with lodging, prepared meals, or beverages for immediate consumption.

Wages in this industry are typically low. In 2004, leisure & hospitality wages in the U.S. were 57% of the all industry average. In 2005, leisure & hospitality was the nation's sixth largest industry, employing 12.8 million employees. Nationally,

employment in this industry is projected to increase by 17.7% between 2004 and 2014, above the all industry average.

Other Services. Other services includes service industry establishments that are not elsewhere classified such as equipment repair, religious activities, laundry services, personal care, pet care, and death services, photofinishing, and other services.

In 2004 other service wages in the U.S. were about 11% lower than the all industry average in the U.S. In 2005, other services were the nation's tenth largest industry, employing 5.4 million employees. Employment in this industry is projected to increase by 11.8% between 2004 and 2014, slightly slower than the all industry average.

Government. This sector is made up of federal, state and local government. Government wages vary by level. Typically federal government wages are well above the all industry average while state and local government wages are slightly below the all industry average. Government employment is projected to increase by 1.6% in the U.S between 2004 and 2014. Employment in state and local government (combined) is projected to increase by 11.3% between 2004 and 2014.

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